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Number 5

Mariners Weather Log

National Oceanic and Atmospheric Administration • Environmental Data and Information Service

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Front Cover: This tethered horse depicts the violence, frustration, and isolation associated with the high winds and heavy rains during a hurricane. This photograph was taken as hurricane Allen neared the Texas coast. For a description of Allen, see page 353. Wide World Photo.

Back Cover: This satellite image was taken just a few hours before hurricane Allen reached a pressure of 899 mb. This was the lowest pressure ever observed in the western Caribbean, lowest ever measured by a reconnaissance aircraft in the North Atlantic, and the second lowest pressure ever recorded in the North Atlantic. NOAA Satellite Photo.

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Mariners Weather Log

Editor: Elwyn E. Wilson
Editorial Assistant: Annette Farrall

September-October 1980
Volume 24 Number 5
Washington, D.C.

Routing
Master _____

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PLEASE PASS THIS ISSUE ALONG

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1983.

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Mariners Weather Log

PUSAN AS A TYPHOON HAVEN

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Editor's Note: This is the sixth in a series of articles evaluating the safety of ports as shelters from tropical cyclones. These are edited versions of studies that appear in the Typhoon Havens Handbook for the Western Pacific and Indian Oceans by Samson Brand and Jack W. Bielloch, June 1976, Naval Environmental Prediction Research Facility, Monterey, Calif.

It has been more than 2 decades since typhoon Sarah devastated the port of Pusan. In addition, some 5,400 South Korean fishing vessels were sunk or badly damaged. Typhoons Irving and Judy provided a real scare during August 1979. Fortunately, both weakened before landfall. Even so, their torrential rains triggered floods and mudslides that left thousands homeless and 261 dead. It is just a matter of time before another powerful typhoon roars up the East China Sea and raises havoc in the port of Pusan.

It is the conclusion of this study that, if possible, all ships should evacuate from Pusan when threatening tropical-cyclone conditions exist. Both the inner and outer harbors are susceptible to strong winds and storm surges; the outer harbor is also vulnerable to heavy seas. The preferred evasion technique is to evade the tropical cyclone in the Sea of Japan or, if need exists to remain in Korean waters, to seek shelter in Chinhae Bay.

THE SETTING

Pusan Harbor (fig. 1), Korea's principal deepwater port, is divided by Yong-Do Island into a northern and southern harbor. Both harbors are divided into inner and outer harbors (fig. 2a and 2b). North Harbor accommodates oceangoing vessels, while South Harbor is used primarily by coastal vessels. Unless otherwise stated, reference to Pusan Harbor will specifically apply to North Harbor. An intensive construction program is underway in North Harbor. This includes dredging of the fairway and construction of container and grain piers. Anchorages are available in the outer and inner harbors. With the exception of a few rocky patches in the outer harbor, good anchor-holding action is available in a mud and sand bottom. The inner harbor is one of few in Korea where deep-draft vessels can berth at piers. It consists of four major piers, tow quays, and six deep-draft anchorages. Cranes, drydocks, and repair facilities are all available.

Pusan Harbor is well protected by hills in all directions except to the southeast and south-southwest, where it faces the sea, and to the north where the

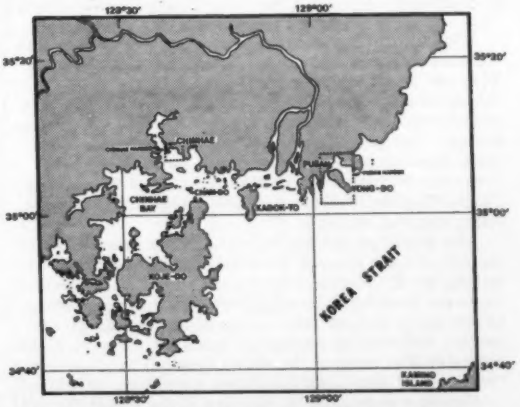

Figure 1.--Locations of Pusan and Chinhae on the southeastern tip of the Korean Peninsula.

Figure 2a.--Panoramic view of Pusan's North Outer Harbor. Photo courtesy of DMAH/TC Navigation Department.

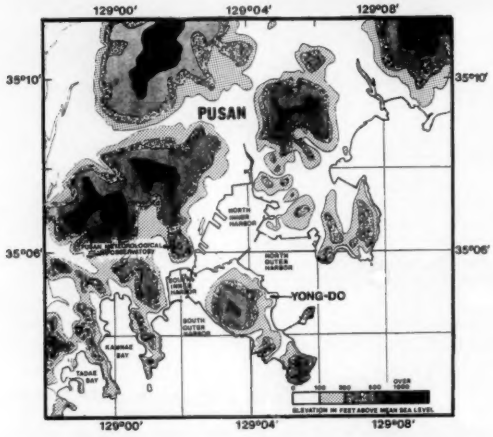

Figure 2b.--Pusan Harbor and surrounding topography.

port opens into a valley. The range of tides in Pusan Harbor is approximately 4 ft. In the narrow channels between Yong-Do Island and Pusan Harbor, tidal currents attain velocities of 3 to 4 kn.

THE CLIMATOLOGY

The climatology of tropical cyclones for Pusan and Chinhae Harbors will be combined, since the two harbors are less than 20 mi apart and Chinhae is one of the options for evasive action. The midpoint of a line between the two harbors was used to define this climatology. For purposes of this study, any tropical cyclone that entered a 180-mi circle radially outward from this midpoint was considered to be a "threat" to Pusan/Chinhae Harbors and was designated a threatening tropical cyclone.

The threat period for Pusan/Chinhae extends from the end of June through the middle of October (fig. 3). During the 27-yr period of record 1947-73, 57 tropical cyclones threatened Pusan/Chinhae, an average of approximately two per year. August is the peak threat period, followed by September and July. Figure 3 also indicates that most of the threat tropical cyclones were "recurvers" (had a northeasterly component of motion).

Figure 4 shows that 81 percent of the threat tropical cyclones entered the threat area from a sector extending from southeast through southwest. Of the 57 threatening tropical cyclones during June to October (1947-73), 54 percent passed to the west and 46 percent passed to the east of the midpoint of a line between Pusan and Chinhae. Therefore, the chances of having a threat tropical cyclone pass to the west of this midpoint are

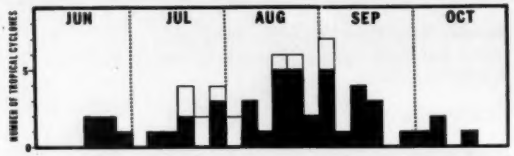

Figure 3.--Frequency distribution of the number of tropical cyclones that passed within 180 mi of Pusan/Chinhae. Subtotals are based on five-day periods for tropical cyclones that occurred during 1947-73. Shaded areas indicate the number of recurving tropical cyclones per five-day period.

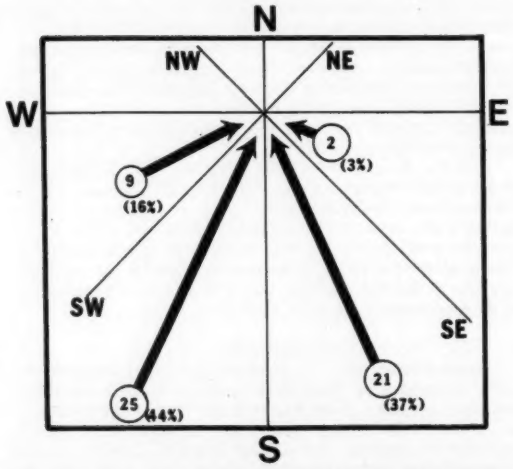

Figure 4.--Directions of approach to Pusan/Chinhae of tropical cyclones that passed within 180 mi of Pusan/Chinhae during the period 1947-73. Circled numbers indicate the number of tropical cyclones that approached from each octant. This is expressed as a percentage in ( ).

somewhat greater than passage to the east.

Nearly half of the threatening tropical cyclones affecting Pusan/Chinhae either travel over or dissipate on the southwestern tip of Japan. As a result of a tropical cyclone's interaction with land, the maximum wind intensity decreases. However, from the end of July through the beginning of September, the mean sea-surface temperatures in the Sea of Japan and Yellow Sea are favorable for a tropical cyclone's reintensification when it leaves the southwestern tip of Japan.

Figures 5 to 9 are based on an analysis of threatening tropical cyclones from June to October, 1947-73. The approach times (dashed lines) are based on the average speeds of movement of tropical cyclones that affect Pusan/Chinhae. The solid lines represent the "percent threat" for any storm location. For example, in figure 5, a storm at 30°N, 130°E, has a 40-percent probability of passing within 180 mi of Pusan/Chinhae, and it could reach Pusan/Chinhae in less than 1 day.

Note the significant shift in direction from which threatening tropical cyclones approach Pusan/Chinhae. In June, the approach is generally from the southwest, whereas in July it is from the southeast. During August the threat sector extends from southeast to south, and in September it extends from the southeast and southwest. During October the threat sector narrows again and is primarily from the south-southeast.

Strong winds can be expected from the north-northeast, southeast, and south-southwest of Pusan since little topographic protection from these directions exists. Southerly winds would be associated with a threatening tropical cyclone passing to the west of Pusan, while northerly winds would result from passage to the east.

Wind observations from the Pusan Meteorological Observatory for June to October, 1948-73, were analyzed to determine the extent to which threatening tropical cyclones produced strong winds ($\geq$ 22 kn) or gale-force winds ($\geq$ 34 kn) at Pusan (table 1). The close proximity of the Observatory to the harbor (35°06'N, 129°02'E) (fig. 2) makes the winds recorded at the station generally representative of the wind conditions experienced in the harbor.

A study of the tracks of threatening tropical cy-

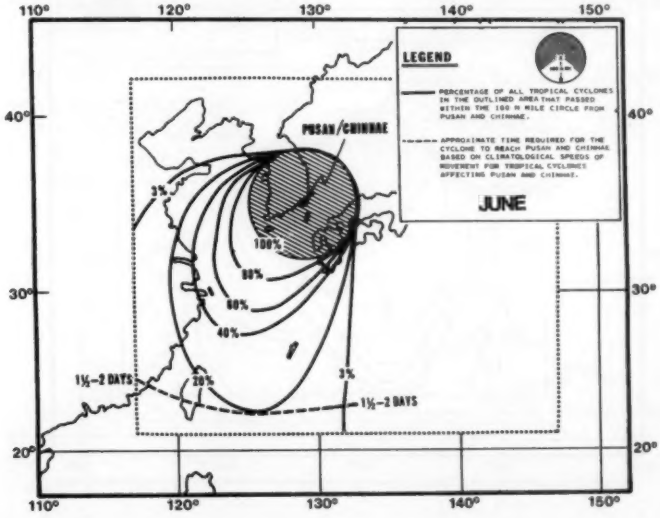

Figure 5.--Probability that a tropical cyclone will pass within 180 mi of the midpoint of a line between Pusan and Chinhae Harbors for the month of June (based on data for June-October, 1947-73).

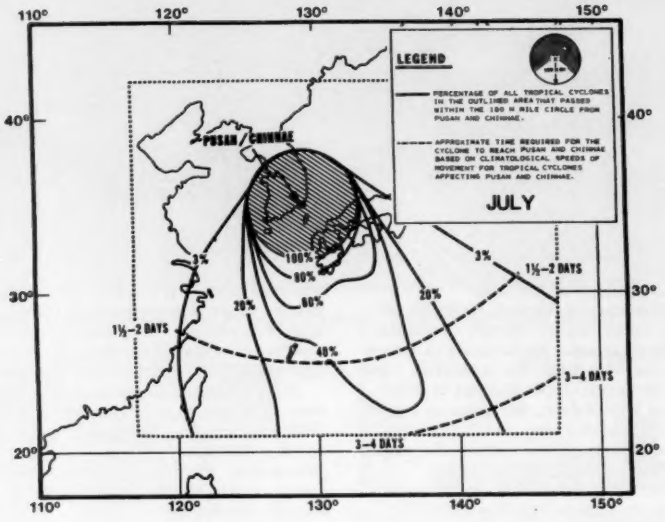

Figure 6.--Probability that a tropical cyclone will pass within 180 mi of the midpoint of a line between Pusan and Chinhae Harbors for the month of July (based on data for June-October, 1947-73).

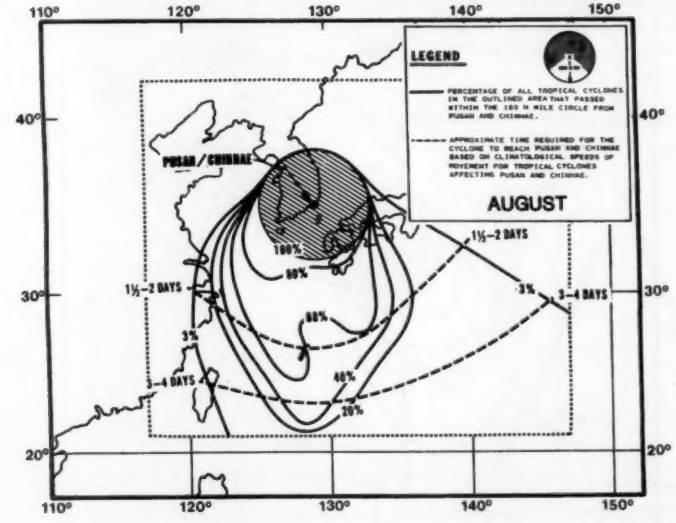

Figure 7.--Probability that a tropical cyclone will pass within 180 mi of the midpoint of a line between Pusan and Chinhae Harbors for the month of August (based on data for June-October, 1947-73).

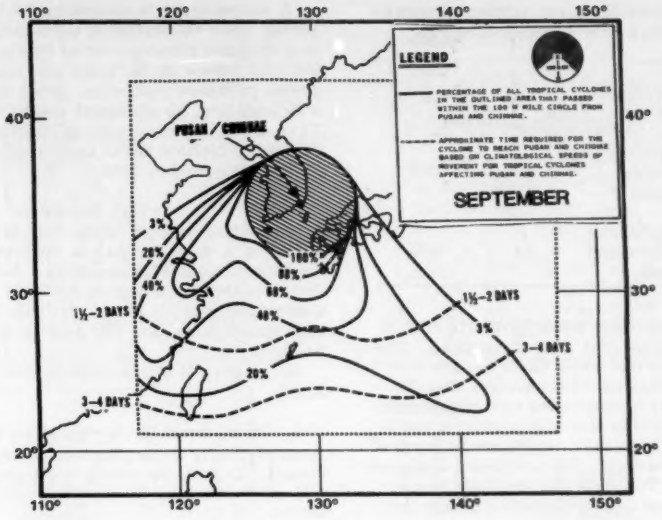

Figure 8. --Probability that a tropical cyclone will pass within 180 mi of the midpoint of a line between Pusan and Chinhae Harbors for the month of September (based on data for June-October, 1947-73).

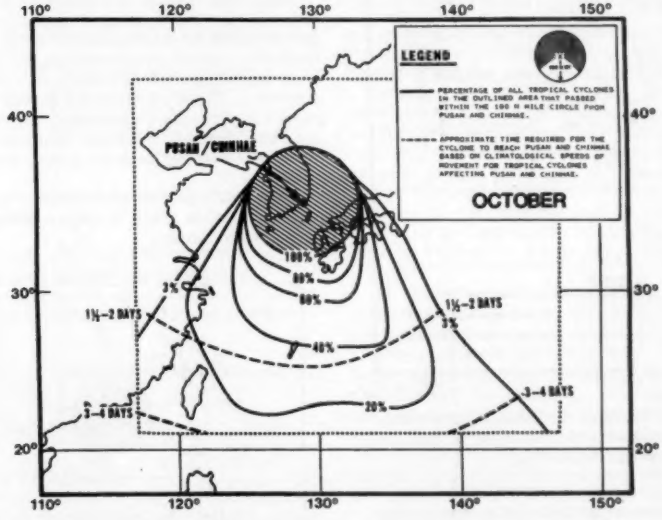

Figure 9. --Probability that a tropical cyclone will pass within 180 mi of the midpoint of a line between Pusan and Chinhae Harbors for the month of October (based on data for June-October, 1947-73).

Table 1.--Extent to which threat tropical cyclones affected Pusan during June-October, 1948-73

Number of tropical cyclones that threatened Pusan	55	--
Number of threat tropical cyclones resulting in strong (≥ 22 kn) winds in Pusan	37	67%
Number of threat tropical cyclones resulting in gale-force (≥ 34 kn) winds in Pusan	16	29%

clones showed that gale-force winds have occurred at Pusan in each month from June through October. The gale-producing systems are more likely to pass west of Pusan (62 percent) than east (38 percent) (fig. 10). The most severe threat is associated with the storms that pass just west of Pusan since the resultant southerly, particularly southeasterly, winds are unimpeded before they reach the harbor. The maximum sustained windspeed recorded at Pusan during the study period was 70 kn in 1959 during typhoon Sarah's passage just 10 mi west of Pusan.

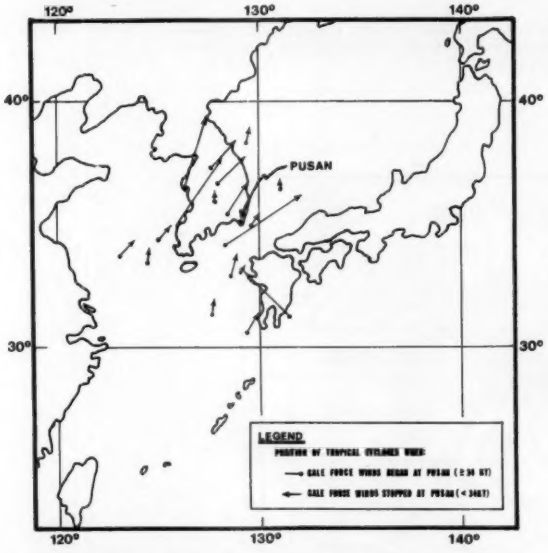

Figure 10.--Positions of tropical cyclone centers when ≥ 34 kn winds first and last occurred at Pusan (based on data for June-October, 1948-73).

Wave heights generated by typhoon-strength winds (≥ 64 kn) are dependent upon wind direction and harbor location. In the North Outer Harbor, where a 100-mi fetch exists to the southeast, southerly winds from typhoons passing to the west can build wave heights to 12 ft, compared to about 4 ft in the North Inner Harbor. With winds from the north, when typhoons pass to the east of Pusan, the inner harbor is slightly more exposed, and maximum wave heights of 5 ft can be expected compared to 4 ft in the outer harbor.

A storm surge is evident in the inner harbor when strong south-to-southeast winds are generated by tropical cyclones passing west of Pusan. This results from the wind stress on the water and the effects of atmospheric pressure reduction. When this surge coincides with high tide, an abnormal rise in water level occurs. This storm tide can cause serious damage as was the case when typhoon Sarah came ashore 10 mi west of Pusan in September 1959.

THE DECISION

Remaining in port when it is possible to evade a storm is a decision that is contrary to most of the traditional rules of seamanship. However, if the decision to remain in port is made, it should not be done without considering every available fact concerning the impending storm and the port in which the vessel is berthed.

In the case of Pusan Harbor, the following should be noted:

1. North Inner Harbor provides little protection from northerly winds (tropical cyclone passage east of Pusan). In fact, the valley to the north of the harbor will act to increase the wind velocity by its funneling action.

2. North Outer Harbor is exposed to southeasterly winds (tropical passage west of Pusan). In addition, the large fetch to the southeast can produce a sea state up to 12 ft.

3. A storm surge effect is possible; and when combined with high tide, it may be dangerous.

When the evasion of a tropical cyclone is being considered, the importance of correctly assessing the threat posed by the storm and acting quickly to retain flexibility cannot be overemphasized. The following time table (figs. 11-15) has been constructed for this purpose. The area enclosed by the threat axis represents 30-percent or greater probability of being threatened by a tropical cyclone. Note how the orientation of the threat axis shifts from month to month.

1. An existing tropical cyclone moves into or development takes place in area A with forecast movement toward Korea:

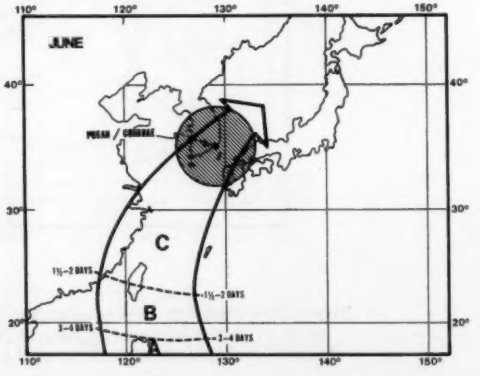

Figure 11.--Tropical cyclone threat axis for June.

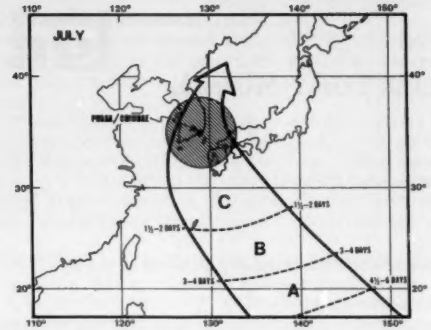

Figure 12.--Tropical cyclone threat axis for July.

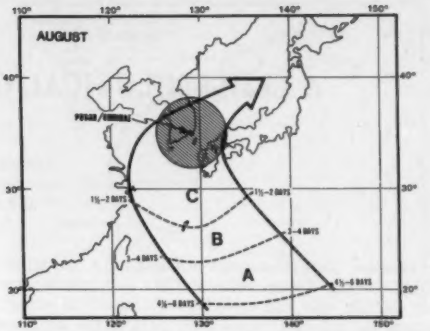

Figure 13.--Tropical cyclone threat axis for August.

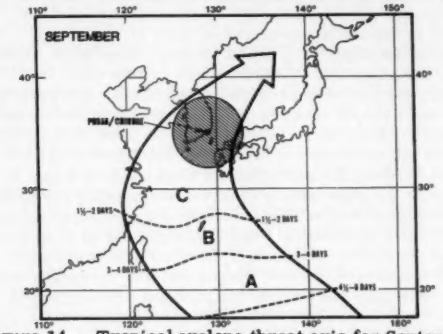

Figure 14.--Tropical cyclone threat axis for September.

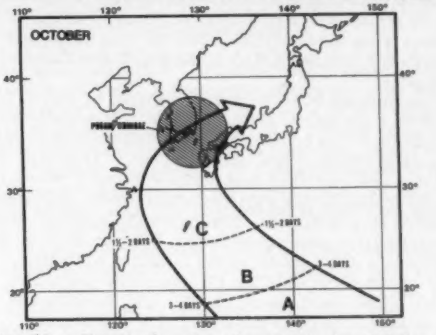

Figure 15.--Tropical cyclone threat axis for October.

a. Decide whether evasion is to be at sea or to Chinhae Bay.
b. Review material condition of ship; sailing may be desirable 2 to 4 days hence.
c. Reconsider any maintenance that would render the ship incapable of getting underway within 48 hr.

2. Tropical cyclone enters area B with forecast movement toward Pusan:

a. All ships begin planning course of action to be taken if sailing becomes necessary.
b. Reconsider any maintenance that would render the ship incapable of getting underway within 24 hr.

3. Tropical cyclone enters area C with forecast movement toward Pusan:

a. Execute evasion plans made in previous steps.

THE EVASION

Evasion from Pusan Harbor is the preferred course of action under potentially threatening tropical cyclone conditions. The following evasion tactics are recommended:

1. Evasion to the Sea of Japan--This route takes the ship to higher latitudes, where the intensity of the tropical cyclone decreases markedly. The Sea of Japan provides ample maneuvering room to place the ship in the navigable or "safe" semicircle of the tropical cyclone. This evasion route also allows a ship to cross to the Pacific Ocean from the Sea of Japan through Tsugaru Kaikyo between the southern tip of Hokkaido and the northern tip of Honshu.

When considering this tactic, remember that unless done early, it is likely that the tropical cyclone will overtake the ship, since the speed of movement of the tropical cyclone once it enters the Sea of Japan often exceeds 25 kn. However, at the same time the intensity of the tropical cyclone decreases as it reaches the more northerly latitudes and the effects of the associated wind and sea will be much less intense than if the tropical cyclone is met at lower latitudes.

2. Evasion to Chinhae Bay north of Koje-Do--This is the the evasion tactic used by larger Republic of Korea Navy ships. It is recommended if it is necessary to remain in Korean waters. Chinhae Bay is a large, landlocked bay formed by the northwest side of Koje-Do and the mainland. The bay is entered from the east through the deep passage on either side of Cham-Do (fig. 1). The bottom of the bay is predominantly mud and shell and provides good anchor-holding action. Protection from strong winds is available in the bay for winds from all directions.

The only damage reported from ships in Chinhae Bay during a typhoon were associated with typhoon Sarah in 1959, which passed approximately 10 mi to the west of Pusan with central winds over 90 kn. Several vessels ran aground in Chinhae Bay because they were not properly anchored. The damage to Pusan Harbor was much more severe.

If the threatening tropical cyclone is forecast to have sustained winds greater than 110 kn, it would be prudent to evade to the Sea of Japan.

Mariners Weather Log

A CLIMATOLOGICAL OIL TRAJECTORY MODEL

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Washington, D.C.

The Marine Environmental Assessment Division (MEAD) of the Environmental Data and Information Service (EDIS) has had specific experience in using climatological oil-spill models as part of the decision-making process. MEAD has done an analysis for the siting of the LOOP and Seadock deepwater ports in the Gulf of Mexico and a proposed oil refinery at Eastport, Maine. They also provided accurate long-term predictions for both the ARGO MERCHANT and Campeche oil spills.

The multiple trajectory analysis used by MEAD is based on a statistical summarization of simulated oil-spill trajectories computed from a climatological data base of archived winds and currents. This type of analysis has been used successfully by many investigators to determine the environmental impact of proposed offshore oil production. The approach, although dynamically a first-order calculation, has proved very effective as will be shown by the following examples. This report documents the EDIS multiple trajectory model, gives examples of its use, and recommends future uses in various models of risk assessment.

OIL SPILL TRAJECTORY MODELS

At the workshop on Government Oil Spill Modeling Activities modelers developed the following characterization of oil-spill models:

- Type I models--multiple trajectory models for long-term (strategic) forecasts based on archived data; and

- Type II models--single-event models for specific day-to-day (tactical) forecasts, usually based on up-to-date data.

Type I models are probabilistic in nature. They use a climatological representation of the ocean currents and an added drift induced by local wind. Ocean currents are represented on a grid, while wind-drift components, for which far greater amounts of usable data are available, are treated as a time series. Tidal motions may be incorporated in nearshore and embayment areas, where they may be deemed to contribute to advective transport. The principal use of these models is pre-spill oil-spill contingency planning.

Some Type I models also incorporate potential impact targets and contain representations of shorelines as potential targets. Few Type I models explicitly include oil weathering estimates. These models also can be used to compute spill trajectories for real-life spills, provided their use is intended to project into the climatological time scale (i.e., periods of weeks to months). Locally induced wind drifts are generally treated by the wind-factor approach. Generally, oil drift speeds are estimated at 3 percent of the windspeed, and oil-drift angle is either 0° or +15° relative to the wind direction.

Type II models are used for a spill that has occurred. Thus, the driving forces (i.e., winds, currents) acting on the spill are determined from real-time or forecastable parameters. The principal use of these models is for containment and cleanup purposes and for scientific support of the on-scene coordinator (OSC) during actual spills. These models can be more effectively applied to nearshore, embayment, and harbor areas and provide more detailed information than Type I trajectory forecasts. The success of Type II models depends upon accurate forecasts of windspeed and direction. Thus, the advantage of working with Type II models is the high quality of output concerning the spill in question. Disadvantages include the limited response time usually required and the consequences of model input inaccuracies. Also, on Type II models there is a need for research into the dispersion and spreading and subsurface transport of oil spills which are critical to determine areal extent and final consequences of the oil spill.

MULTIPLE TRAJECTORY MODEL

In the EDIS multiple trajectory approach, the drift of oil is computed by adding vectorially the wind-induced current and the drift resulting from a permanent background current. To produce conservative estimates of impact, oil spreading is not considered. Oil weathering is considered by allowing a trajectory to continue until a predetermined cutoff time is reached.

The model drift velocity, U, is expressed in this analysis as follows:

$$U = \alpha U_w + U_p \qquad (1)$$

where U_w is the wind velocity taken from a long time series of archived wind data, U_p is the permanent current velocity, and α is the wind factor set equal to 3 percent.

The surface wind-driven current is directed downwind. Although the wind-factor approach does not directly account for variable depth or time dependent effects, it is felt to be appropriate over the long simulation employed. This wind-factor approach has historically been applied to simulate surface oil trajectories and remains popular to date. A critical review in 1977 of oil-spill trajectory models indicated that 9 of 12 models reviewed used the fixed wind-factor approach. The wind factor employed ranged from 3 to 3.5 percent and the deflection angle from 0° to 20° to the right. Several investigators have successfully used the 3-percent rule to hindcast oil-spill movement at sea. Examples include the TORRY CANYON and

the ARGO MERCHANT spills.

The permanent current component, U_p, is defined in this analysis as the long-term (seasonal) average flow calculated from data that spans a time period of years.

Tidal currents are oscillatory and their affect on long-term net advection are neglected, if the oil is more than about 20 km from the coast. This approximation will not affect the conclusion of this climatological analysis because of the relatively minor long-term importance of the tidal current component.

INPUT DATA FOR THE MULTIPLE TRAJECTORY MODEL

The surface transport of the center of gravity of each hypothetical oil spill occurs in time steps according to:

$$U(x,y,t) = 0.03U_W(t) + U_p(x,y) \qquad (2)$$

where $0.03U_W(t)$ is the transient wind-driven current vector. The wind, $U_W(t)$, is taken from the archived time series data of the National Climatic Center (NCC). Another consideration with respect to the wind data used in the model is the normal difference in wind velocity between synoptic land and ocean data. To account for such considerations an adjustment factor, based on offshore data, is applied to the land data.

As oil interacts with the marine environment, it will gradually undergo degradation through evaporation, precipitation, emulsification, and photo-oxidation. Unfortunately, little is known about such processes, and few oil-spill models account for them. A 1977 study indicated that only 2 of 12 models reviewed included such processes. In this analysis, degradation is not directly included, but it is implicitly employed by stopping simulations when the hypothetical slick has not reached land after a given number of days.

The model simulation series computes the hypothetical path of a given spill by calculating the transport in 3-hr time steps using equation (2). The trajectories are tracked on a computer which follows the geographic location of the spill. Trajectories are stopped after 50 days or after the shore has been impacted. A new trajectory from the original location of the spill is started after the wind record is advanced 72 hr to allow one to get into another meteorological condition. The 72 hr agrees with the annual storm movement in the westerlies giving major wind shifts every 2 to 4 days.

USES OF CLIMATOLOGICAL OIL TRAJECTORY MODEL

The climatological oil trajectory model has been used extensively in evaluating the consequences of the siting of both onshore and offshore oil facilities. Examples of this type of analysis that were performed at MEAD are:

1. LOOP and Seadock deepwater port study,
2. Pittston oil refinery study, and
3. a Coast Guard oil tanker lightering study for the Gulf of Mexico.

In the deepwater port study NOAA was required to make a recommendation to the Secretary of Transportation concerning a state's "adjacent coastal state" status. In short, this means that any state that could be adversely affected by oil spills due to the construction of a deepwater port by another state would be compensated. In the NOAA analysis, using the EDIS multiple trajectory climatological model, it was found that the port to be built off the coast of Louisiana (LOOP) would cause maximum impact to Louisiana, and the port to be built off the coast of Texas (Seadock) would cause maximum impact to the Texas coast (fig. 16). Thus, neither state was determined to have "adjacent coastal state" status.

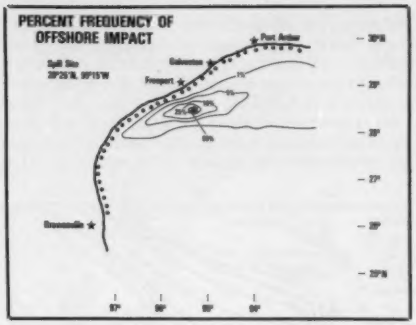


Figure 16.--Example of the multiple trajectory (climatological) analysis used in the NOAA/DOT Deepwater Ports Project for determination of the Texas "adjacent coastal state" status.

A second example of the use of this type of model as an aid in risk assessment was its use in the siting of the Pittston oil refinery near Eastport, Maine. Environmentalists were concerned when this location was proposed because of weather conditions and navigation hazards coupled with high environmental values. MEAD implemented its oil trajectory model to estimate probable areal extent of hypothetical oil spills. A Type II model was also employed in the analysis to obtain an estimate of the concentration of oil in the water given a typical spill. This information was presented in a public hearing as part of a overall NOAA report on the project. Generally, the report supported the environmentalists, as large areas of important resource regions possibly would be impacted by spills near the proposed port site.

A third application of this climatological model was to project the drift of oil from various locations in the Gulf of Mexico being considered by the Coast Guard as

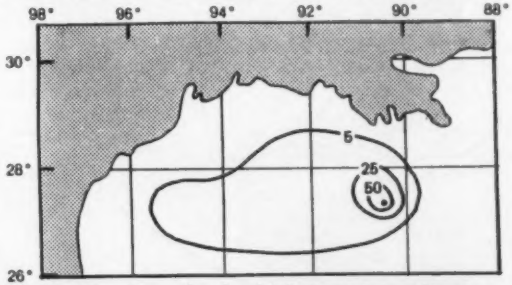


Figure 17.--Example of multiple trajectory (climatological) analysis used in the NOAA/USCG Oil Tanker Lighering Study. Contours are percent frequency of offshore impact for spills starting at the proposal lightering site (dot).

possible sites for offshore tanker lightering operations. The Coast Guard was tasked to designate an optimum location for such operations. Typical model results presented to the Coast Guard are shown in figure 17.

One can see from these examples that the climatological oil trajectory model is a useful tool for decision-makers in planning site locations and in determining the possible environmental impact of hypothetical oil spills.

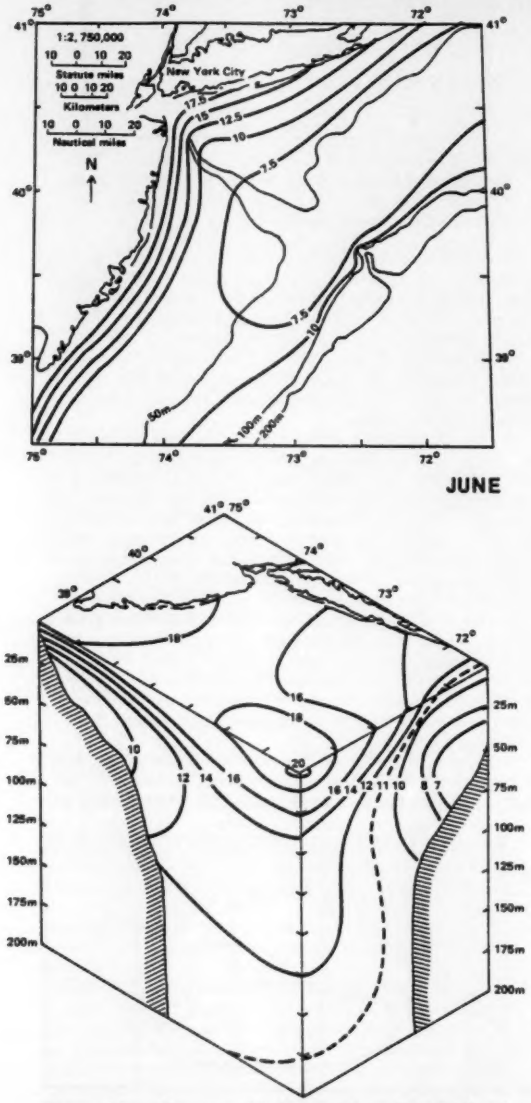


Figure 18.--Mean monthly temperature distribution in the New York Bight. Map pairs show bottom contours (top), surface and vertical contours (bottom). Units are °C.

The combination of Type I and Type II models gives the more complete picture of impacts: the Type I model identifies high-risk areas, and the Type II model estimates concentration levels for typical spills.

PRE-SPILL CONTINGENCY PLANNING GUIDES

As an aid in operational forecasting and contingency planning, EDIS has published the first of a series of Climatological Oil Spill Planning Guides for the New York Bight area. This guide is based on EDIS archived meteorological and oceanographic data specifically related to the problem of the fate of oil at sea. It summarizes appropriate environmental data, discusses the movement of oil at sea, and predicts the effects of oil spills. The guide was produced for the Coastal Region II Response Team. Examples of the type of information available in this publication are shown in figures 18 to 21.

Such data as mean currents, density stratification, ocean front locations, and mean winds also are being made available regionally in a number of published volumes. Oil Spill Planning Guides for other areas are planned.

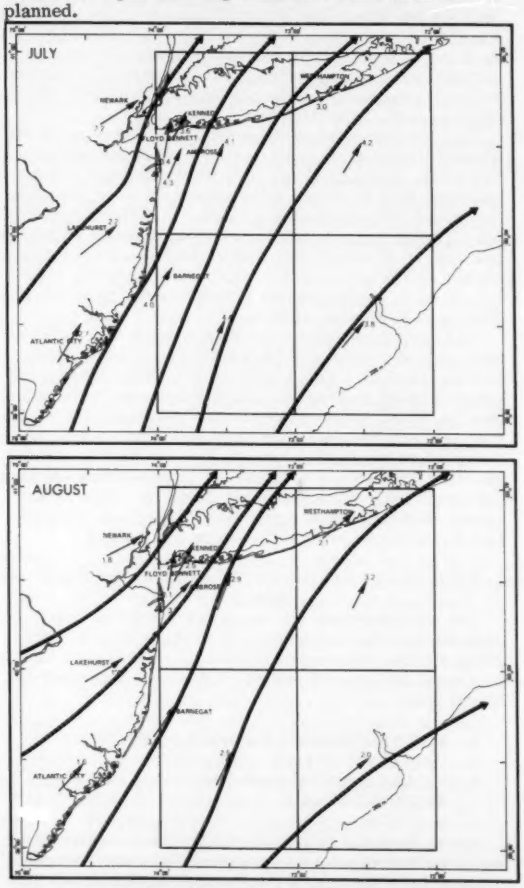


Figure 19.--Monthly mean wind vectors in knots.

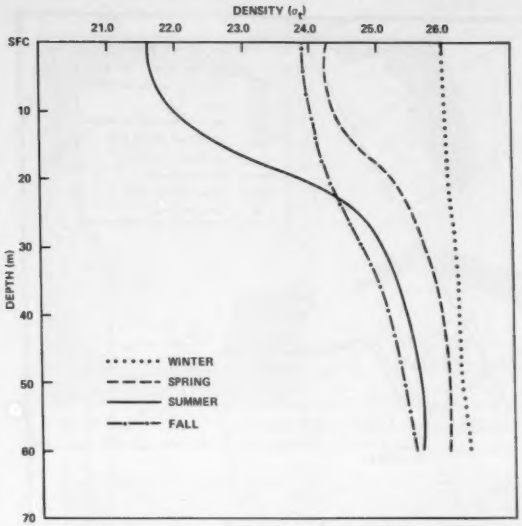


Figure 20.--Mean vertical density profiles.

CLIMATOLOGICAL PREDICTIONS OF LARGE OIL SPILLS

In mid-December 1976, the captain of the Liberian tanker ARGO MERCHANT made a 180° error in his reading of an RDF navigational signal. The result was the subsequent grounding of the vessel with the loss of 7.7 million gallons of No. 6 fuel oil on Nantucket Shoals off the coast of Massachusetts. The tanker broke apart on December 21, discharging its entire cargo into the

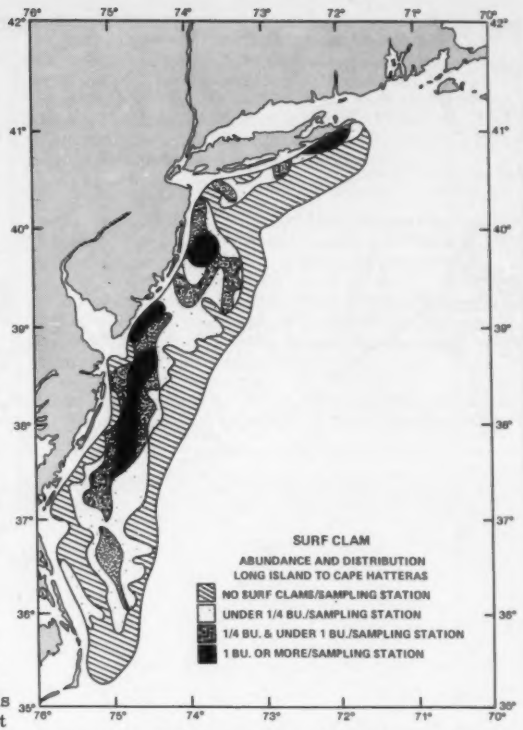


Figure 21.--Natural resource chart for surf clams.

Figure 22.--The ARGO MERCHANT broke up on Nantucket Shoals resulting in a major oil spill. U.S. Coast Guard Photo.

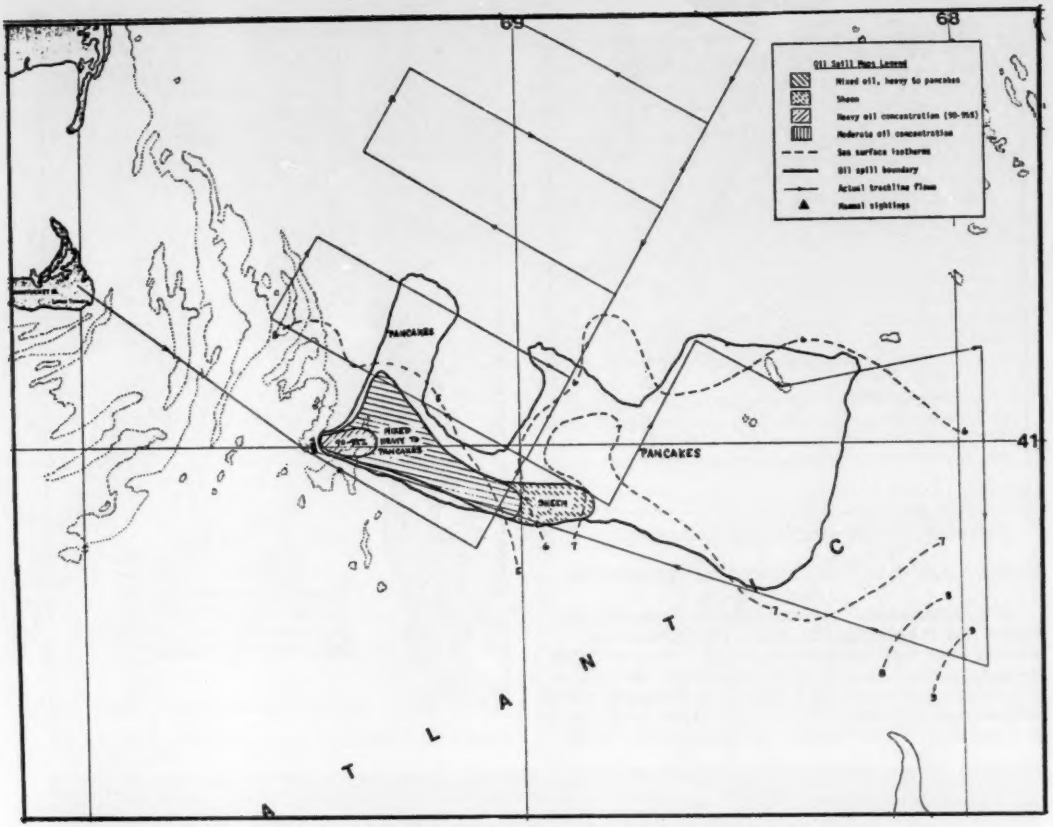


Figure 23.--Map of location of the ARGO MERCHANT oil spill for December 21, 1976.

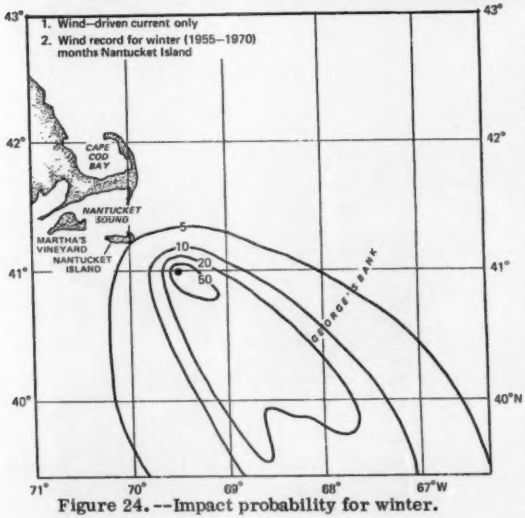


Figure 24.--Impact probability for winter.

sea (fig. 22). The U.S. Coast Guard, the governmental focal point for response, is generally considered the best equipped and has the most highly trained personnel of this kind in the world. Regardless, their efforts could not prevent the spill or recover 1 gal of the millions of gallons of spilled oil. Hundreds of scientists took part in activities connected with the spill. Despite this support, there was a noticeable lack of usable information from which response decisions could be made. This became very apparent to EDIS after receiving a telephone call from the Coast Guard requesting oil trajectory estimates. Within a few hours climatological relative risk trajectory charts were produced based on the EDIS model. With the absence of specific site data for input, more sophisticated modeling efforts proved almost useless. The results generally agreed with the observed oil trajectories as shown on a typical chart for December 21, 1976 (figs. 23 and 24).

The climatological model was employed in real time for the near term estimates of the coastal impact of the IXTOC-1 spill (fig. 25). This was appropriate because of the long travel time and distance between the spill and the U.S. coast. Figure 26 shows the agreement between the model prediction and the spill.

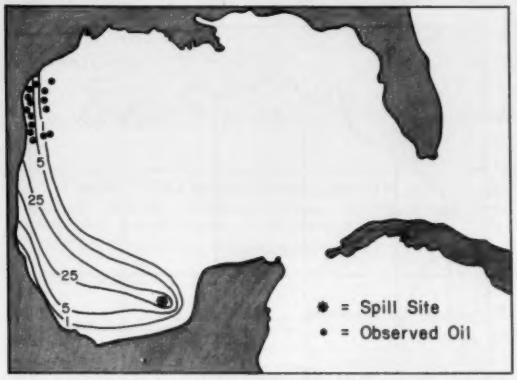


Figure 25.--The Bay of Campeche spill comparing 6 mo model assessment with observed oil.

At the request of the U.S. Coast Guard the MEAD climatological model also was exercised for the Campeche oil spill for the long term. Hypothetical oil spills were initiated at the well head for each month of the year. The results are given in figures 27 and 28 which indicate the relative impact for 100 mi^2 offshore areas. Conclusions drawn from the results are:

1. Trajectories initiated in the summer have a low, but finite probability of impact along the Texas coast with average transit times of about 30 to 50 days.

2. Increased magnitude of the actual permanent current (especially the Mexican Current) will increase the probability of U.S. coastal impact and decrease average transit time to the U.S. coast.

3. The region of the U.S. coast that has the highest probability of being impacted is from Brownsville to Galveston, Tex.

Figure 26.--The smaller light area near the center of the photo is burning gas above the IXTOC-1 well. The larger area is a concentration of oil above the well. U.S. Coast Guard Photo.

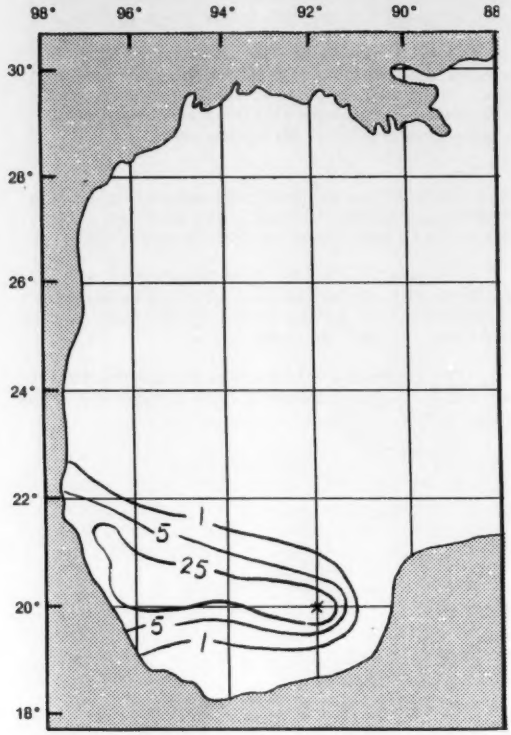


Figure 28.--Climatological oil spill probability (percent frequency) of impact from the Campeche Oil Spill (summer).

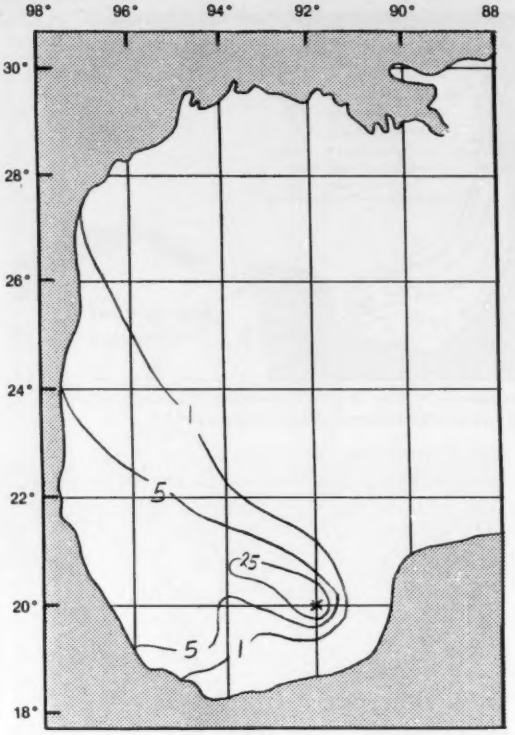


Figure 29.--Climatological oil spill probability (percent frequency) of impact from the Campeche Oil Spill (winter).

4. The model projected impact along the U.S. coast from late summer until fall, if the well was not capped before the summer of 1980.

CONCLUSION

The use of the relatively unstructured multiple trajectory model based on climatological data has been helpful in making decisions concerning the fate of oil at sea. The statistical nature of the model output leads to a lesser requirement for involved model dynamics and gives probability outputs that allow various options to be considered. The climatological oil trajectory model had been used effectively in the past and will continue to supply useful information to the decision maker in the future.

WE OF NOAA ARE MAKING USE OF THIS SMALL AMOUNT OF SPACE TO EXTEND OUR THANKS TO ALL THE SHIPS' OFFICERS WHO ROUTINELY TAKE SHIPBOARD WEATHER OBSERVATIONS. TO US, THESE EXCELLENT OBSERVATIONS ARE PRICELESS. WE CERTAINLY DO APPRECIATE RECEIVING THEM REGULARLY.

Hints to the Observer

WIND-CHILL CHART: KNOTS AND KILOMETERS PER HOUR VERSUS DEGREES CELSIUS

Figure 30 has been published several times previously, but the windspeeds were in miles per hour and the temperature in degrees Fahrenheit. This wind-chill chart has been converted to knots and kilometers per hour versus degrees Celsius making it much more convenient for the mariner. It is Weather Service Form TA B-0-25 (6/76).

WS FORM TA B-0-25 (6-76)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NOAA–NATIONAL WEATHER SERVICE WIND CHILL CHART

WIND SPEED Kilometers Per Hour	EQUIVALENT WIND CHILL TEMPERATURE °C (Wind speeds greater than 70 Km/Sec (35 Knots) have little additional chilling effect.)													WIND SPEED Knots
70	-7	-14	-20	-27	-33	-40	-46	-52	-59	-65	-72	-78	-85	38
60	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-70	-77	-83	32
50	-6	-12	-18	-25	-31	-37	-43	-49	-56	-62	-68	-74	-80	27
40	-5	-11	-17	-23	-29	-35	-41	-47	-53	-59	-65	-71	-77	22
30	-3	-8	-14	-20	-25	-31	-37	-43	-48	-54	-60	-65	-71	16
20	0	-5	-10	-15	-21	-26	-31	-36	-42	-47	-52	-57	-63	11
10	5	0	-4	-8	-13	-17	-22	-26	-31	-35	-40	-44	-49	5
6	8	4	0	-4	-8	-12	-16	-20	-24	-28	-32	-36	-40	3
	8	4	0	-4	-8	-12	-16	-20	-24	-28	-32	-36	-40	

AIR TEMPERATURE °C

This chart serves only as a guide to the cooling effect of the wind on bare flesh when a person is first exposed. General body cooling and many other factors affect the risk of freezing injury. The equivalent wind chill temperatures used on this chart are based upon a neutral skin temperature of 33° C. With physical exertion, the body heat production rises, perspiration begins, and heat is removed from the body by vaporization. The body also loses heat through conduction to cold surfaces with which it is in contact and in breathing cold air that results in the loss of heat from the lungs. This chart, therefore, does not take into account all possible losses of body heat. It does, however, give a good measure of the convective cooling that is the major source of body heat loss.

Figure 30.--Equivalent wind chill chart for winds in knots and kilometers per hour versus air temperature in °C.

Tips to the Radio Officer

Thomas H. Reppert
National Weather Service, NOAA
Silver Spring, Md.

The new edition of Worldwide Marine Weather Broadcasts, dated June 1980, has been distributed to ships participating in the Cooperative Observer Program and is available to the public from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. This publication contains information on selected marine weather broadcasts in all areas of the world where such service is provided. In general, English language broadcasts are listed. There are separate sections on radiotelegraph, radiotelephone, radiofacsimile, radioteleprinter, and weather broadcasts for the Great Lakes and NOAA Weather Radio.

Much of the information on worldwide weather broad-

casts and the continuing changes that occur come from the radio officers of the merchant fleet. We are grateful to the radio officers for this service and actively solicit information from all sources on new or changed weather broadcasts. All contributions will be acknowledged in this column.

CORRECTIONS TO WORLDWIDE MARINE WEATHER BROADCASTS (JUNE 1980 EDITION)

Page 19
1-0770 Pt. Reyes, CA NMC
Delete time 0200, insert 0500. Add frequency 472.

1-0790 Los Angeles, CA KOK
Delete area (a) Equator northward, east of 160°E; amend area (b) to read: Coastal waters, area 8.

1-0810 Long Beach, CA NMQ
Delete station.

1-0870 Vancouver, BC, Canada CKN
Delete time 0000, insert 0030.

Page 53
2-1230 Kodiak, Alaska NOJ
Delete times and frequencies; insert 0030, 1330 157.1 MHz (F3).

2-1232 Valdez, Alaska NMJ-3
Delete times and frequencies; insert 0015, 0615, 1215, 2015 157.1 MHz (F3).

2-1250 Ocean Cape, Alaska NMJ-19
Delete times and frequencies; insert 0203, 1403 157.1 MHz (F3).

2-1261 Juneau, Alaska NMJ-1
Delete times and frequencies; insert 0203, 0303, 1403, 1503 157.1 MHz (F3).

2-1270 Biorka Island, Alaska NMJ-18
Delete station.

Page 54
2-1280 Ketchikan, Alaska NMJ
Delete times 0315, 1515, and frequency 2670.

Page 55
2-1470 Humboldt Bay, CA NMC-11
Delete time 1545, insert 1615.

Page 56
2-1481 Monterey, CA NMC-6
Delete time 1545, insert 1615.

2-1490 Long Beach, CA NMQ
Delete station.

2-1510 La Jolla, CA WWD
Delete frequencies 4409.4, 8789.6; insert 4431.8, 8644.1.

Page 84
Add station Coos Bay, OR 162.40 MHz.

THE MARINERS WEATHER LOG WELCOMES ARTICLES AND LETTERS FROM MARINERS RELATING TO METEOROLOGY AND OCEANOGRAPHY, INCLUDING THEIR EFFECTS ON SHIP OPERATIONS.

Hurricane Alley

Dick DeAngelis
Environmental Data and Information Service, NOAA
Washington, D.C.

HURRICANE ALLEN PRELIMINARY

The following preliminary report was provided by the National Hurricane Center. It was prepared by Gilbert Clark.

A disturbance moved off the northwest African coast on July 30. By August 1 the second tropical depression of the season had developed when satellite pictures indicated the consolidation of two circulation centers within the large cloud mass of the African disturbance. Allen reached tropical storm strength early on the 2d and hurricane strength by that evening. When the first reconnaissance aircraft penetrated the center on the afternoon of the 3d, Allen had winds of 110 kn and a minimum pressure of 967 mb. The pressure

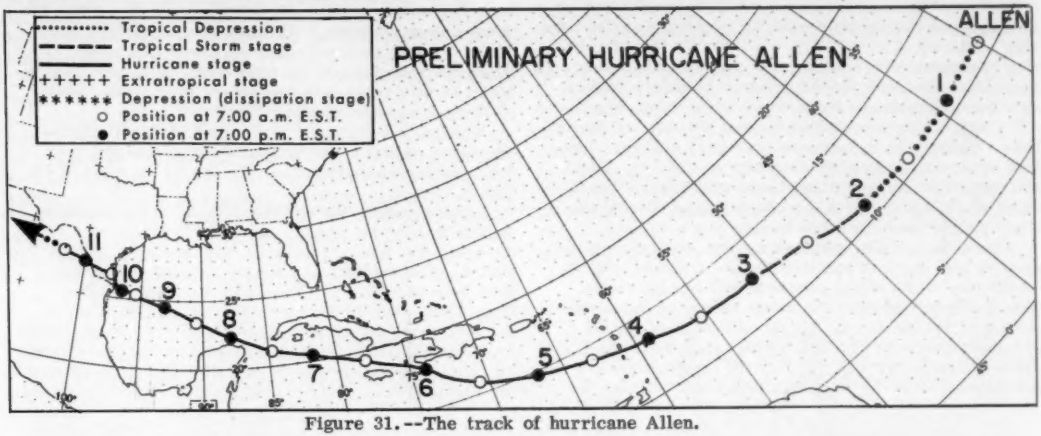


Figure 31.--The track of hurricane Allen.

Figure 32.--A gigantic wave crashes against reefs which parallel the coastline of Santo Domingo. Wide World Photo.

dropped to 951 mb by evening as the eye passed just north of Barbados and south of St. Lucia (fig. 31). Heavy rains caused flash flooding on St. Lucia. Preliminary damage estimates in Barbados totalled $1.5 million. About 500 houses were damaged or destroyed, but no deaths were reported. Eighteen people were killed on St. Lucia, which sustained heavy damage. The only other death reported in the Windward and Leeward Islands was on Guadeloupe.

Allen moved westward at 15 to 20 kn into the Caribbean. His minimum pressure fell to 911 mb south of Puerto Rico on the evening of the 4th--the lowest pressure ever recorded in the eastern Caribbean. Maximum winds were estimated up to 155 kn the following day. As the large circulation spread over Hispaniola, Allen turned west-northwestward, bringing the center just south of Haiti's southwestern peninsula on the evening of the 5th (fig. 32). He weakened as his circulation interacted with mountainous terrain of Haiti and Jamaica. However, he did produce extensive damage with strong winds and flash floods over Haiti, where 220 people were reported killed and 835,000 left homeless. Damage was estimated over $400 million. One half of the nation's coffee crop was destroyed. There was extensive damage along the immediate northeast coast of Jamaica, but only minor damage elsewhere. Eight people were reported killed.

Thereafter, Allen resumed a more westerly course, passing just north of Jamaica and the Cayman Islands on the 6th. His central pressure fell rapidly as the circulation moved over the warm waters of the northwestern Caribbean Sea. On the afternoon of the 7th a minimum pressure of 899 mb was observed in the Yucatan Channel. This is not only the lowest pressure ever observed in the western Caribbean, but also the lowest ever observed by a reconnaissance aircraft in an Atlantic hurricane, and the second lowest ever recorded in the Atlantic, Caribbean, and Gulf of Mexico according to modern records. The aircraft measured 165-kn winds at flight level; surface winds were estimated at 170 kn.

When the southern portion of Allen's circulation moved over the Yucatan peninsula during the night of the 7th, the moist southerly inflow to the hurricane's center was cut off. The minimum pressure rose very rapidly again, reaching 961 mb the following morning.

There were no reports of significant damage from Cuba, although 3 people died. Allen passed north of Cayman Islands, but Cayman Brac was raked by winds over 100 kn and sustained considerable property damage, but no casualties. No significant damage was reported from Mexico. The extreme northeast coast of the Yucatan peninsula was very near the center of Allen but remained on the weak side. The northeast Mexican Gulf coast was also on the weak side. Both of these areas are sparsely populated.

While Allen continued west-northwestward across the warm waters of the Gulf of Mexico, his pressure fell rapidly to a minimum of 909 mb by the night of the 8th.

Allen's course through the Atlantic and Caribbean was controlled by a large, warm high-pressure system covering the western Atlantic and southern United States. This system was nearly stationary and may have been partially reinforced by the warm outflow from Allen. As the hurricane moved into the Gulf of Mexico, general pressure falls began over the southern United States, indicating that Allen should begin slowing its rapid forward speed and possibly turn more toward the north. The expected decrease in forward speed did

Figure 33.--Huge waves whipped up by hurricane Allen lash a seawall at a beach in Corpus Christi as he hit the Texas coast. Wide World Photo.

not occur until Allen approached the Texas coast on the 9th. Even though the ridge over the southern States weakened markedly, its main effect was to slow Allen's forward speed. The western portion of the ridge did not retreat far enough to allow the hurricane to turn northward. This spared the heavily populated sections of the middle and upper Texas coast from storm surges up to 15 ft.

Allen did only a fraction of the damage that had been feared, because he weakened just prior to reaching the coast, and his path sent the highest storm surge and strongest winds over the sparsely populated coastal section between Brownsville and Corpus Christi, Tex. (fig. 33). Allen caused two drownings in the Corpus Christi area. Indirectly caused deaths included 13 in an oil company evacuation helicopter which crashed while taking workmen from the Louisiana offshore oil rigs, 4 in an offshore oil rig collapse off the Louisiana coast, 3 fishermen swept off the jetties by large swells in the Galveston area, and 2 victims of heart attacks. There were also several deaths in automobile accidents during the period of evacuation. Estimated total damage caused by high tides, strong winds, flooding, and tornadoes in Texas was $600 million (fig. 34). The major damage in Louisiana was the destruction of two $30-million oil drilling platforms and damage to other platforms off the Louisiana coast. It has been calculated that nearly half a million people evacuated the coastal sections of Texas and Louisiana.

Tides rose 3 to 5 ft above normal along the upper Texas and western Louisiana coasts, with higher levels in the area of maximum storm surge from Corpus Christi southward. There is no way of estimating the maximum storm surge, since it occurred over the unpopulated section of Padre Island between Brownsville and Corpus Christi. A survey by aircraft the day after Allen moved inland showed numerous cuts and washouts over a 50-mi stretch of Padre Island, north of where the center moved inland.

The strongest measured winds were 120-kn gusts at Port Mansfield. The peak gust at Brownsville Airport was only 68 kn. An oil rig 50 mi east of Brownsville recorded 120-kn sustained winds. Elsewhere, gusts to 80 kn occurred at Corpus Christi Airport and to 95 kn at nearby Aransas Pass (front cover).

Rainfall of 10 to 15 in fell over south Texas along the track of Allen for up to 150 mi north and 50 mi south of the center. More than 16 in was measured at Falfurrias, and over 15 in at Raymondville and Alice. There were at least a dozen tornadoes reported in south and central Texas. Two were confirmed in Brownsville. More than eight tornadoes were observed over inland areas west and north of Corpus Christi. In Bishop, several businesses sustained heavy damage and part of the high school roof was blown off. Tornadoes in central Texas injured about 20 people at a campground near San Marcus and caused an estimated $50 million damage at Austin Airport, primarily to hangars and corporate jets.

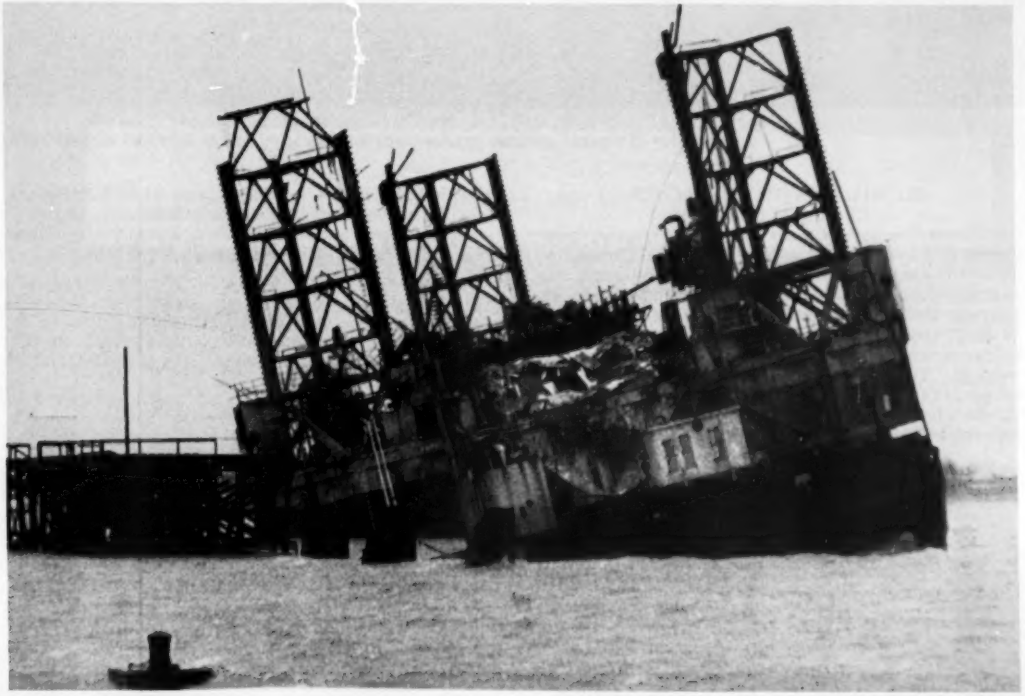


Figure 34.--A barge carrying an offshore oil rig at Port Isabel, Texas lists from taking on water during hurricane Allen. Wide World Photo.

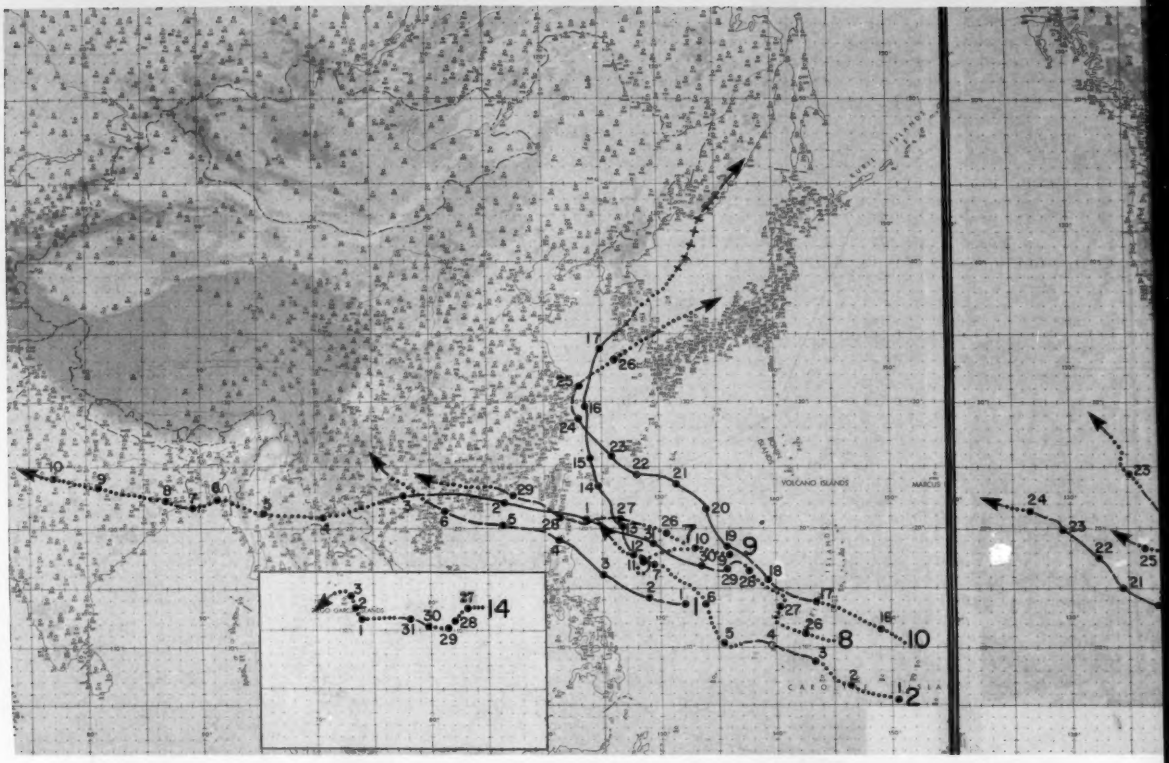


Figure 35.--Tropical cyclone tracks worldwide originating in July and August 1979.

GLOBAL TROPICAL CYCLONES JULY AND AUGUST 1979

Sixteen tropical cyclones roamed the tropical seas during this 2-mo period in 1979 (fig. 35). Except for an out-of-season storm in the South Indian Ocean, all activity was confined to the Northern Hemisphere. The average number of tropical cyclones is about 21, with 11 or 12 reaching hurricane strength. The culprit was below-normal activity in the Pacific, both eastern and western. Ten tropical cyclones reached hurricane intensity. Of these David was the strongest, generating 150-kn winds (table 2). Judy and Hope both reached supertyphoon intensity (winds 130 kn or more). Hope traveled to two basins. She began east of the Mariana Islands, moved through the South China Sea, across southeast Asia, and into the North Indian Ocean. This resulted in an out-of-season storm for this region.

Table 2.--Global tropical cyclone summary, July and August 1979

No.	Name	Peak Intensity	Est. max. wind (kn)	Basin	Dates
1	Ellis	H	85	W. North Pacific	July 1-6
2	Faye	T	40	W. North Pacific	July 1-7
3	Bob	H	65	North Atlantic	July 9-16
4	Carlos	T	45	E. North Pacific	July 14-16
5	Claudette	T	45	North Atlantic	July 16-29
6	Dolores	H	105	E. North Pacific	July 17-23
7	Gordon	T	60	W. North Pacific	July 25-29
8	Hope	H	130	W. North Pacific	July 25-Aug. 10
9	Irving	H	90	W. North Pacific	August 9-17
10	Judy	H	135	W. North Pacific	August 15-26
11	Enrique	H	125	E. North Pacific	August 17-24
12	Fefa	H	100	E. North Pacific	August 21-25
13	David	H	150	North Atlantic	Aug. 25-Sept. 8
14	Tony	T	50	South Indian	Aug. 26-Sept. 3
15	Elena	T	35	North Atlantic	Aug. 29-Sept. 2
16	Frederic	H	115	North Atlantic	Aug. 29-Sept. 15

TROPICAL CYCLONE WATCH - 1980

The tropical cyclones that have developed through August of 1980 appear in table 3. This list must be considered preliminary, since we occasionally miss a storm in the Southern Hemisphere.

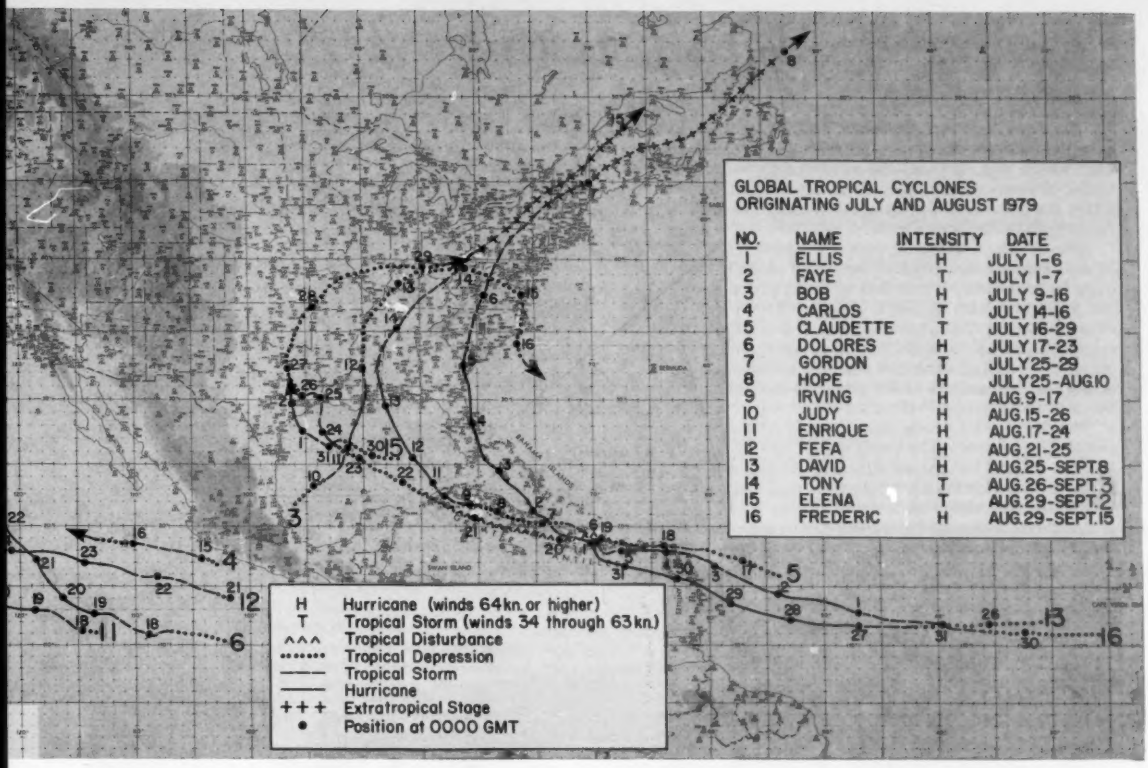

GLOBAL TROPICAL CYCLONES
ORIGINATING JULY AND AUGUST 1979
NO. NAME INTENSITY DATE
1 ELLIS H JULY 1-6
2 FAYE T JULY 1-7
3 BOB H JULY 9-16
4 CARLOS T JULY 14-16
5 CLAUDETTE T JULY 16-29
6 DOLORES H JULY 17-23
7 GORDON T JULY 25-29
8 HOPE H JULY 25-AUG. 10
9 IRVING H AUG. 9-17
10 JUDY H AUG. 15-26
11 ENRIQUE H AUG. 17-24
12 FEFA H AUG. 21-25
13 DAVID H AUG. 25-SEPT. 8
14 TONY T AUG. 26-SEPT. 3
15 ELENA T AUG. 29-SEPT. 2
16 FREDERIC H AUG. 29-SEPT. 15
H Hurricane (winds 64 kn. or higher)
T Tropical Storm (winds 34 through 63 kn.)
Tropical Disturbance
Tropical Depression
Tropical Storm
Hurricane
Extratropical Stage
Position at 0000 GMT

Table 3.--World tropical cyclone watch, 1980

Eastern North Pacific		
Agatha	H	June
Blas	T	June
Celia	H	June
Darby	T	July
Estelle	T	July
Frank	T	July
Georgette	H	July
Howard	H	July
Isis	H	Aug.
Javier	H	Aug.

Western North Pacific		
Carmen	T	April
Dom	H	May
Ellen	H	May
Forrest	T	May
Georgia	T	May
Herbert	T	June
Ida	T	July
Joe	H	July
4-80	T	July
Kim	H	July
Lex	H	July
Marge	H	Aug.
Norris	H	Aug.

North Atlantic		
Allen	H	July
Bonnie	H	Aug.
Charley	H	Aug.

Australia-South Pacific		
Peni	T	Jan.
Amy	H	Jan.
Paul	T	Jan.
Brian	H	Jan.
Dean	H	Jan.
8-80	T	Feb.
Enid	H	Feb.
Fred	H	Feb.
Simon	H	Feb.
Sina	H	March
Doris	T	March
Gloria	H	March
Tia	T	March
Val	T	March
Wally	T	April

South Indian		
Hyacinth	H	Jan.
5-80	T	Jan.
Jacinthe	H	Feb.
Kolia	T	Feb.
Laure	H	March
15-80	T	March

On the Editor's Desk

MARYLAND CRANE MISHAP

The June accident at the Dundalk Marine Terminal in which a 600-ton container crane was blown over by high winds (fig. 36) was the result of an unfortunate chain of events, according to an investigation conducted by the Maryland Occupational Safety and Health Agency (MOSHA).

The crane, which will cost approximately $2.5 million to replace was totally destroyed when it was blown over backwards by winds that were recorded at 89 mi/h. An inspector with MOSHA said it was an unfortunate chain of events that prevented the Maryland Port Administration (MPA) from getting an adequate advance warning of the pending wind and weather conditions, but he could find no basis to issue citations for safety violations.

The 210-ft-tall crane was secured with drop pins and its brakes set after work with it was completed at Berth 7 about 11 a.m. on June 29. It was not secured to the pier deck with tie-down rods and turnbuckles, a procedure that would have enabled it to withstand winds of 120 mi/h, because its movement to a tie-down location was blocked by repairs to the crane rails to the north of its location and by two other cranes that were working a ship to the south.

All of the cranes could have been properly secured with the tie-down rods if the MPA had been sufficiently warned. However, because of a series of incidents, the warning was not received until 25 min before the accident occurred.

The MPA receives its weather summaries and special warnings from a private weather firm. On the day of the accident the MPA received a forecast at 7 a.m. that stated thunderstorms had moved out of the area, but more were possible in the afternoon and night. No other forecasts were received until 3:50 p.m., when the MPA police received a telephone warning of gusty winds and heavy thunderstorms to the west approaching the area between 4:15 and 5:00 p.m. with winds up to 50 mi/h, vivid lightning, torrential rains, and possible hail (fig. 37). The weather warning was broadcasted to MPA crane personnel via walkie-talkie, and an immediate shutdown was ordered to set all brakes, drop the pins, and abandon the cranes.

High winds, described by city police as a tornado, hit the Baltimore Zoo, and trees fell on some cages. Wind storms also blew over a bandstand in the city's inner harbor, injuring two people. A tornado also touched down near Centreville, on the eastern shore, causing minor damage but no injuries.

The crane blew over at 4:12 p.m. at a time, according to wind recording instruments at the terminal, the

Figure 36.--Thunderstorm winds blew over this 800-ton, 15-story-high crane, crumpling it like a child's toy. United Press International Photo.

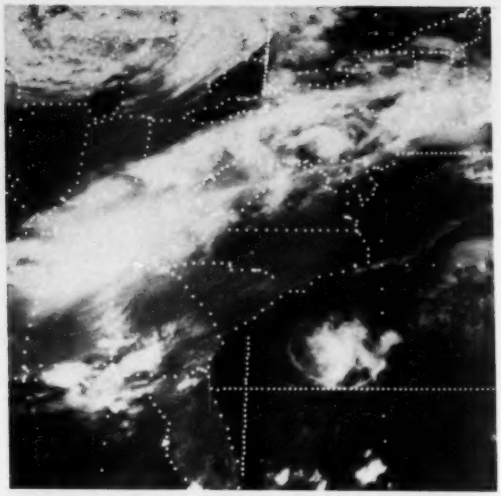


Figure 37.--This 1300 local time satellite picture shows the thunderstorms moving into the Baltimore area.

wind velocity had reached 89 mi/h.

Delay in receipt of the warning was the result of a breakdown in the telex communications system sometime during the early morning hours. Because the telex was broken the private weather firm tried by telephone to contact the MPA police at the Dundalk terminal shortly after 2:15 p.m., but the MPA had had their telephone numbering system changed over the weekend and failed to notify the weather firm. It was 3:50 p.m. when they finally got through.

LIGHTNING APPARENT SOURCE OF ENVIRONMENTALLY IMPORTANT GASES

Lightning may be a source of two environmentally significant gases in the atmosphere.

Laboratory tests at NASA's Langley Research Center, Hampton, Va., show that an electrical discharge approximately equal to that of lightning can produce trace amounts of carbon monoxide and nitrous oxide. Although the annual global rates of production from lightning appear to be several orders of magnitude below that from other sources, the level of nitrous oxide became twice as great and carbon monoxide was increased 100-fold in the vicinity of the laboratory lightning bolt.

Carbon monoxide initiates a complex series of chemical reactions that are believed to lead to the production of beneficial ozone in the lower atmosphere, or troposphere, at altitudes from 6 to 9 mi. Lightning adds to the already large manmade sources of carbon monoxide.

Nitrous oxide, ironically, is harmful because it leads to ozone destruction. It does not destroy ozone in the lower atmosphere, but rises and diffuses into the stratosphere, and is chemically transformed to a gas that depletes the Earth's protective ozone layer. The highly concentrated ozone layer, about 15 mi above the surface of the Earth, absorbs much of the lethal solar ultraviolet radiation, thus shielding inhabitants of the Earth.

The major source of nitrous oxide in the lower atmosphere is thought to result from the action of microscopic bacteria on solid nitrogen compounds in the soil. This diffusion of nitrous oxide from the soil to the stratosphere takes about 25 yr, so that it may be several decades before a measurable decrease in the ozone layer can be detected.

Nitrous oxide produced by lightning, however, may take only hours or days to reach the stratosphere, carried in the rapid updrafts of thunderstorms. Lightning flashes an estimated 500 times a second somewhere around the Earth. Tropical thunderstorms, especially, may be frequent conduits of nitrous oxide.

Lightning was known previously to be a source of nitric oxide, a compound important to the chemistry of the lower atmosphere. Nitric oxide molecules have a single nitrogen atom (NO); nitrous oxide has two (N_2O). The production of gases by lightning results from the high temperatures which occur in the electrical discharge.

Man's environmental responsibilities are not lessened by the finding of lightning-produced carbon monoxide and nitrous oxide, because it is known that man's activities are, in fact, altering the environment. Before man's impact can be fully assessed, the natural processes, such as lightning, that alter the composition of the Earth's atmosphere must be understood.

Information obtained by the NASA Pioneer Venus space probe and U.S.S.R. Venera missions suggests that lightning is a feature of the Venus atmosphere. The discovery led to the suggestion, based on theoretical calculations, that lightning may be a significant source of carbon monoxide in the Venutian atmosphere. Measurements made in the Lightning Facility and the Gas Analysis Laboratory, determined that carbon monoxide was increased dramatically in simulated Venutian atmospheric samples.

Photographs of the dark side of Jupiter, obtained by NASA's Voyager spacecraft, indicate that lightning also may be a feature of the Jovian atmosphere.

In early lightning studies, predating NASA, other researchers discovered that lightning may have been important in the biological processes that led to the origin of life on Earth, by converting nitrogen in the atmosphere from a gas to solid forms. They, in turn, were carried by rain into the oceans. One group of those solid forms of nitrogen would probably have been nitrates, essential building blocks in the origin of life. Lightning also may have supplied the energy that led to the formation of complex organic molecules, the precursors of life on Earth.

SEAWAY SEASON CLOSES DECEMBER 15

United States and Canadian St. Lawrence Seaway agencies have agreed upon a December 15 date to close the passage to shipping for the season. Essentially the same procedures for vessel clearance will prevail this year as last. December 15 is the last day that vessels can report at designated call-in points on the St. Lawrence River for passage. Vessels reporting on December 16 to 19 will be allowed passage, but they will be assessed the same increasing penalty surcharges as last year--$20,000 for 1 day late up to $80,000 for 4 days late.

The most significant change from last year's procedures is that "in no event" will a vessel be accepted for passage through the Montreal-Lake Ontario section after midnight December 19, unless a prior written

agreement has been approved by both United States and Canadian authorities.

The closing procedures specify that by midnight December 15, inbound vessels must have reported at Cap St. Michel, just east of Montreal, and outbound vessels must have reported at Cape Vincent, N.Y., where Lake Ontario flows into the St. Lawrence.

Inbound vessels with destinations above Port Colborne, Ontario, which intend to return outbound before the season's official end, must be accepted for transit at Cap St. Michel by midnight December 4.

HELICOPTER RESCUES 14 FROM SINKING VESSEL

On April 13, a four-man helicopter from Sitka Air Station rescued 1 woman and 13 men from the sinking vessel CATHY R, just off Redfish Cape on the southwest shore of Baranof Island. The 120-ft CATHY R was bound from Seattle to Bristol Bay with a cargo of salt and other supplies for the bay's red salmon season, when she began to founder in gale-tossed seas.

The helicopter was airborne at 7:10 a.m., 20 min after receiving notification. It was 30 min flying time from Sitka to the accident scene. They had two 250-gal pumps aboard, which they were going to lower to the afterdeck of the vessel.

At the time of rescue, the seas were running up to 30 ft, whipped up by a 40-kn gale from the southeast. Visibility was so poor that the helicopter crew had trouble locating the stricken boat and could not pick her up on radar.

As the helicopter was about to lower the first pump, the CATHY R lost power. Already low in the water, she broached and began to roll violently. The helicopter crew ordered the ship's crew to abandon ship and radioed Sitka for another helicopter.

The rescue was completed before the second helicopter was airborne. When the CATHY R's crew was safely aboard the chopper, the aircraft's 10-person capacity limit was exceeded by 8 people, a dangerous overload which put the pilot's skills to the test. He successfully flew the overloaded chopper back to Sitka, 30 mi north of the accident site. The 14 victims were treated at Mount Edgecumbe Hospital for mild hypothermia, cuts, and bruises.

ST. HELENS VOLCANO AIDS STUDIES OF CLIMATE

Scientists are studying the plumes emitted from Mount St. Helens to find out how volcanic eruptions may change the Earth's weather and climate.

St. Helens eruption data collected for the NASA Ames Research Center Aerosol Climate Effects (ACE) program constitute the most complete set of observations ever made of volcanic aerosols in the stratosphere. (Aerosols are fine particles, either solid or liquid, suspended in gas. Smoke, fog, and mist are common aerosols.)

Stratospheric measurements are important because aerosols remain in the stratosphere for months, sometimes years--much longer than they remain in the lower atmosphere.

The NASA-Ames U-2 flew ACE stratospheric sampling missions of the St. Helens plume on May 19, 22, 27, and June 14 and 17. Seven experiments aboard the U-2 were designed to observe the atmosphere after the eruptions of May 18, May 25, and June 12.

Preliminary data analysis indicates the volcanic plumes contained a mixture of solid ash particles and

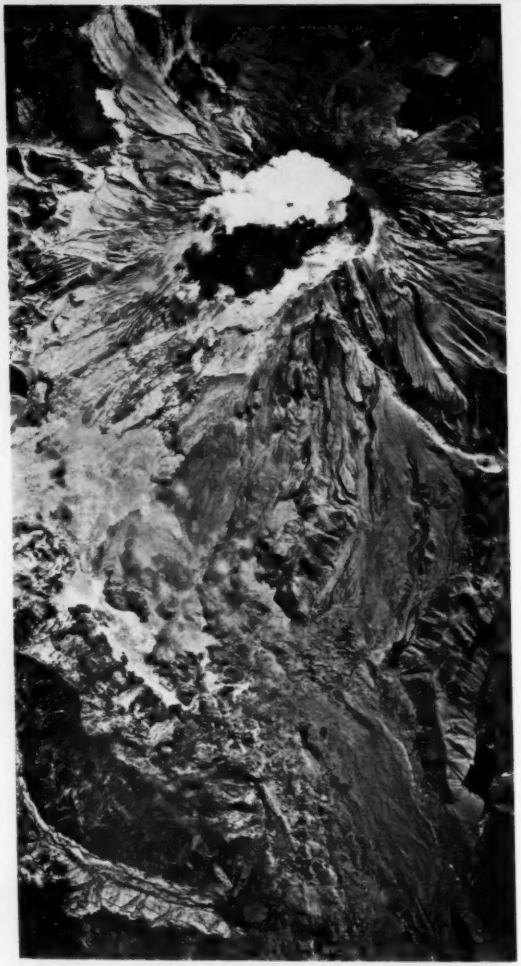


Figure 38.--This photograph was taken by a NASA-Ames U-2 aircraft at 60,000 ft from the northwest. Extensive ice and rock debris in the foreground resulted from the May 18 explosion which blew off 1,300 ft and the north wall of the summit crater. NASA Photo.

sulfuric acid, with proportions varying in different samples. The amount of sulfuric acid found in the stratosphere was several hundred times greater than the amount found prior to the eruptions. Ash particles as large as 30 microns (about .001 in), with a composition similar to ash found on the ground near the volcano, were found on the first flight. On later flights, the largest particles found were about 3 microns (.0001 in).

Large increases in gaseous sulfur dioxide also were detected. Such sulfur-containing gases are sources for additional sulfuric acid particles, which are produced by the action of sunlight on the gas. The sulfur dioxide

levels on the first flight were 10 to 1,000 times ambient levels. On the second flight, sulfur dioxide levels were 100 times normal.

Also on the second flight, water vapor abundance within the plume was at least 10 times its normal amount, indicating that a large amount of volcanic water was injected into the stratosphere.

The ACE program began 1-1/2 yr ago to assess the climatic effect of aerosols in the Earth's atmosphere. Before the May 18 eruption, the ACE scientists had been studying aerosols using U-2 research aircraft observations in conjunction with NASA satellite measurements of global aerosol number densities. A July 1979 ACE flight over Alaska provided baseline levels for comparison to posteruption atmospheric conditions.

The first ACE flight of St. Helens, 21-1/2 hr after the May 18 eruption, was over northern Washington and parts of Idaho, Montana, and Wyoming. The second sampling mission was flown over Boise, Idaho, and Great Falls, Mont.

After the May 25 eruption, a third flight was made along the Canadian coast between Vancouver Island and the Queen Charlotte Islands. After the third eruption on June 12, the U-2 made a flight over Montana on June 14 and a flight over Denver, Colo., and Laramie, Wyo., on June 17.

The pilots could see the plume on the first four flights. On the first flight, the plume spread from above 58,000 ft down to the tropopause at 42,000 ft. The cloud was so dense that the pilot had to fly on instruments for a portion of the 2-1/2 hr sampling.

On the second flight, the visible plume was found in a thin layer at 66,000 ft, about 1,000 ft thick. On the third flight, the plume was a thin layer at 55,000 ft. On the fourth flight, plume debris from the June 12 eruption was visible between 41,000 and 44,000 ft, with an older, thinner layer lying at 62,000 ft.

Over California, the stratosphere at first was relatively unaffected by the eruption. After the debris from the May 18 eruption had circled the Earth, it was observed over California between May 29 and June 3 at 13 km (8 mi) altitude. Regions above that altitude were clear. The material over California was similar to other samples--ash particles mixed with heavy amounts of sulfuric acid.

In addition to the U-2 sampling missions, NASA Ames sent the U-2 aircraft to photograph Mount St. Helens on June 19 (fig. 38). For 1 mo after the May 18 eruption, Ames personnel watched weather maps for skies clear enough to allow the U-2 to photograph the volcanic damage from a height of 65,000 ft.

The photographic mission was requested by the Washington State Office of Emergency Services under the Ames Western Regional Applications Program.

The U-2 photography has given Washington State agencies the first comprehensive coverage of the damaged area. The U-2 camera has a 24-in focal length lens, capable of resolving features 2 to 5 ft in diameter. Each 9- by 18-in frame represents 4 by 8 mi on the Earth below.

The U-2 data will be used in conjunction with the data acquired by the NASA Stratospheric Aerosol and Gas Experiment (SAGE) satellite for studies aimed at assessing the potential climatic consequences of the Mount St. Helens eruptions.

HAWAII TO TAHITI SHUTTLE EXPERIMENT

The Hawaii to Tahiti Shuttle Experiment was conducted as part of the North Pacific Experiment (NORPAX) from February 1979 to June 1980. This project studied the equatorial current system in the central Pacific Ocean for 16 consecutive months to observe the low-frequency variations of the equatorial temperature, salinity, and density structure; their relation to the equatorial currents; and the forcing of these variations by the wind systems. Of particular interest was the relationship between the predominantly zonal equatorial currents in the central Pacific Ocean and events in the eastern and western equatorial Pacific. Another goal of the experiment was to find out how closely the relationships between dynamic topography, thermal structure, sea level, geostrophic flow, and geostrophic transports can be determined, and how these relationships can be exploited for the monitoring of the low-frequency fluctuations of the equatorial circulation by simple observations like sea level measured on islands and temperature sections made by ships of opportunity.

The experiment was scheduled during the Global Weather Experiment for maximum benefit from the extensive meteorological data coverage of the tropical ocean and simultaneous oceanographic efforts in other parts of the Pacific Ocean. The project, under the direction of Klaus Wyrtki of the University of Hawaii, consisted of several individual, but closely coordinated programs. The National Science Foundation provided most of the funds, including funds for the use of the two research ships GYRE and WECOMA. The Office of Naval Research provided most of the P-3 aircraft support and airborne expendable bathythermograph (AXBT) probes, and NOAA provided the research ship OCEANOGRAPHER for two deployments of current-meter moorings and P-3 aircraft for five flights. To determine the proper sampling density

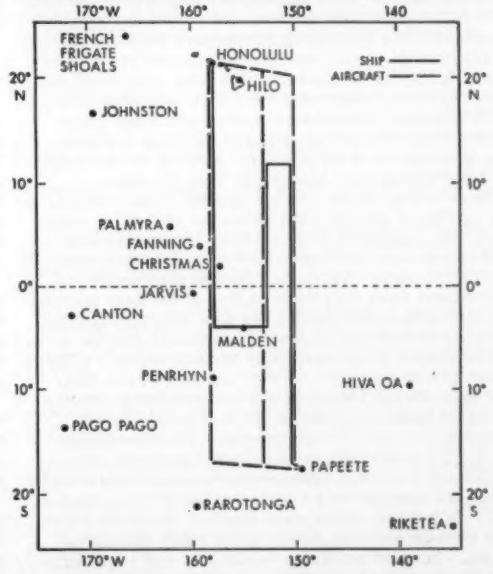


Figure 39. -- The tracks of the ships and aircraft for the experiment.

for the main experiment, a Test Shuttle Experiment was conducted from November 1977 to February 1978 to define the time and space scales of fluctuations in the structure and circulation of the equatorial Pacific Ocean.

The Shuttle Experiment consisted of monthly cruises between Hawaii and Tahiti along three meridians (fig. 39). The first 5 cruises were made by the research vessel GYRE of Texas A&M University and the remaining 10 cruises by the research vessel WECOMA of Oregon State University. Additional temperature sections were obtained from aircraft by AXBT along the same meridians. Thrity flights were made by Navy P-3 aircraft and five by NOAA aircraft. The NOAA research ship OCEANOGRAPHER twice deployed a cluster of current-meter moorings near the Equator, with recovery and redeployment by the WECOMA.

The shipboard core program consisted of vertical profiles of temperature, conductivity, and oxygen content to 1,000-m depth at every degree of latitude and longitude along the ship's track. This work was done by the Physical and Chemical Oceanographic Data Facility of Scripps Institution of Oceanography. Between CTD stations additional XBT profiles were obtained. These measurements, together with the AXBT sections, will document the changing temperature, salinity, and density structure and allow the computation of geostrophic flow. Direct measurements of the flow field were also made from the ships by means of profiling current meters to 500-m depth at all stations between 12°N and 4°S, and at 1/2-degree intervals across the equatorial undercurrent.

A doppler speed log was used for continuous profiling of the current structure in the upper 150 m. At the Equator a cluster of three moorings with five current meters in the upper 300 m of the ocean was maintained during the entire experiment to measure the flow in the Equatorial Undercurrent. To measure trajectories of the flow, 60 drifting buoys were deployed during the experiment, their positions determined from satellites. During the two special observing periods of the Global Weather Experiment the GYRE served as 1 of the 40 tropical wind-observing ships and made upper air soundings with Omega-tracked balloons to determine atmospheric wind profiles. Routine meteorological observations were also made from the ships.

Observations of sea level at islands in the area of the experiment and the wind field over the entire tropical Pacific, available from satellite observations of cloud motion, provided additional data for interpretation of the oceanic data set. Standard meteorological observations were also made at five of the Line Islands.

A preliminary analysis of the data indicates that the thermal structure of the central equatorial Pacific in 1979 developed in an essentially normal fashion, which is very advantageous for further analysis of the data, since they are not biased by any extraordinary events. The major ocean currents in the region--the North Equatorial Current flowing westward, the Countercurrent flowing eastward, and the South Equatorial Current flowing westward again--were very persistent and stable, and changed only slowly throughout the experiment. Only a few eddies were found in the North Equatorial Current and even fewer in the South Equatorial Current. Most of the faster variability was concentrated in the equatorial zone between 5°N and 5°S.

Real-time ship and aircraft data were used to monitor the changing thermal structure across the Countercurrent. It was very strong in February 1979, when the 20-degree isotherm rose by 110 m across the current and the divergence along 10°N was very intensive. The current strength decreased steadily until the end of May, when the corresponding slope was less than 30 m. It then increased again to more than 100 m in September, and remained that strong until February 1980. Transports in the Countercurrent during 1979 changed from a maximum of 35 million m^3/s to a minimum of only 5 million m^3/s.

Direct measurements of the Equatorial Undercurrent have found transports which are higher than ever measured before. This subsurface current flows east between about 50 and 250 m depth symmetrically about the Equator between approximately 3°N and 3°S, with a maximum speed of about 1.5 m/s. The maximum transport measured was 70 million m^3/s, and transports above 60 million m^3/s were sustained for at least 3 mo. These maximal transports in the undercurrent were found at the same time that the Countercurrent was weakest. The current meter moorings anchored at the Equator confirmed the strong, consistent eastward flow of the undercurrent.

The trajectories of ocean circulation were determined by means of satellite-tracked drifting buoys. The six buoys launched in the Countercurrent in July drifted 4,000 km to the east before they turned north in December and entered the westward-flowing North Equatorial Current. Their average speed in the Countercurrent was 40 km/day, and they remained together as a group.

Evaluation of all the data collected during the Experiment will take several years. The ocean's response to the variable atmospheric forcing will be studied, computer simulation of this response will be made and tested against the observations, and methods will be devised to monitor the changing ocean circulation by simple observations.

HAWAIIAN WIND TURBINE DEDICATED

On July 3 officials from NASA, Department of Energy (DOE), Westinghouse Electric Corporation, and the Hawaiian Electric Company gathered at Kahuku Hills on the Island of Oahu to dedicate an experimental 200-kW wind turbine for the generation of electricity. Now, the energy in the ocean breezes off the north shore of Oahu, known for producing giant waves for this country's best surfing, will be captured and converted into electricity.

The wind turbine was designed for DOE by NASA's Lewis Research Center in Cleveland. It was built by Westinghouse Electric Corporation under contract to NASA and will be operated by the Hawaiian Electric Company, which will collect test data on the performance of the wind-turbine system.

DOE expects wind energy to be economically attractive in the near future. The goal is to develop better and less-expensive wind turbines that can generate electricity at costs comparable to conventional power plants.

Wind turbines are placed at utility sites to determine the performance and economics of wind-energy systems interconnected with conventional power plants, supplying power through existing utility lines. Test data collected helps make decisions concerning future design, location, and operation of wind-energy systems.

The machine at Oahu, which has been named Makani Huila (wind wheel), has two rotor blades spanning 125 ft and producing 200 kW of electric power at windspeeds between 18 and 34 mi/h. At these windspeeds, it can provide power for 100 average homes.

An automatic control system, located at the wind-turbine site, monitors wind direction and rotates the machine so that the rotor is properly alined with the wind. The control system brings the machine up to speed and locks it into the utility power system whenever the windspeed rises above 8 mi/h.

Between 8 and 34 mi/h, the control varies rotor blade pitch in order to control power output. If the windspeed is above this span, the control system "feathers" the blades to shut down the system. During these periods, the conventional power plant picks up the load.

Hawaii is actively investigating large wind-energy systems as well as other forms of alternate energy, because the State is 95-percent dependent on oil. The Hawaiian Electric Company now imports oil from Indonesia, the Middle East, Alaska, and the U.S. West Coast to service the Island's electric power needs.

The Hawaiian installation will be the fourth such federally sponsored 200-kW wind machine tested at a utility site. The other machines are at Clayton, N.M.; Culebra, P.R.; and Block Island, R.I. A larger 2,000-kW experimental wind turbine is at Boone, N.C. The first of a cluster of three 2,500-kW machines is scheduled to be installed at Goodnoe Hills, Wash., late this year on the Bonneville Power System.

DROWNING VICTIMS SHOULD NOT BE GIVEN UP FOR DEAD TOO SOON

NOAA is urging that apparent drowning victims not be given up for dead, even though they have been under water a long time. A NOAA-sponsored study at the University of Michigan under its Sea Grant Program showed that persons often thought beyond assistance can be revived and can recover without brain damage.

In one instance, Michigan researchers found this true for a victim who had been submerged for 38 min. Previously, it was thought that anyone under water for longer than 4 min suffered irreparable brain impairment.

The Michigan study concluded that the key to saving a potential drowning victim is aggressive and sustained resuscitation. The researchers also found that water temperature is an important factor in reviving drowning victims. Those who had been pulled from water with temperatures below 70°F had the better chance of being revived.

A review of 25 cases showed that 20 victims who had been submerged for more than 5-1/2 min in water below 70°F recovered fully when given immediate and continuous resuscitation. The victim who had been below water 38 min was one of these.

The researchers found that when victims fall into cold water, changes occur in the body's metabolism, and all oxygen remaining in the system automatically goes to the heart, brain, and lungs. This reflex, known as the "mammalian diving reflex," is a phenomenon peculiar to mammals.

The Michigan study cited the case of a young child who fell head first into his diaper pail while his mother was in another room. When she discovered the youngster 10 min later he appeared dead. He had no pulse, his pupils were fixed and dilated, and he had turned blue. The mother began resuscitation and continued it until medical aides arrived. At the hospital more extensive assistance was given the youngster who survived and had a full recovery.

The Michigan researchers emphasized that drowning victims often appear dead when they are not. Thus, resuscitation should begin immediately, using any of the standard techniques taught by the American Red Cross, Heart Association, or other organizations, and should continue until medical assistance arrives.

LETTERS TO THE EDITOR

MARINERS WEATHER LOG HELPS IDENTIFY FLOATING OBJECT

The text below was excerpted from a letter from Captain E.H. Gregson of the motor vessel ORBITA. A copy of the letter was sent to the NOAA Data Buoy Office for their information.

June 29, 1980

The Editor
Mariners Weather Log
National Oceanographic Data Center
EDIS/NOAA
Washington, D.C. 20235

Dear Sir,

While on passage from Bermuda to Freeport, Bahamas, the Second Officer sighted an object in the water at 1300 local time June 28. After closer inspection, the following TTT message was transmitted to NMF Norfolk at 1653Z:

"CQ All ships 1707Z and VRT Bermuda Radio 1720Z 28th. Position 29°08'N, 70°42'W, at 1630Z passed floating object approximately 12 ft in diameter. Top pink and rusty, possibly 5 ft in depth with red and yellow sections. Easterly drift. Danger to Navigation Master."

I joined the vessel recently and came across a copy of the November 1979 Mariners Weather Log. It is some time since I have seen a copy, being on trades which don't receive them. This morning I looked through it and transmitted the following cable to NMR for NMF:

"Reference my TTT message of 1653/28th sighting floating object in position 29°08'N, 70°42'W, it was similar to buoy shown in photograph page 361 of the Mariners Weather Log November 1979, Vol. 23, No. 6. It was floating in a similar position to that in the photograph and the red and yellow sections were similar to the buoy markings on page 379. Master."

This explained the floating object and we now know that it was a buoy. Figure 6 on page 380 shows the drift of the buoy from Station 41001 and is much farther north of "our" buoy. The May 1980 Pilot Chart of the North Atlantic shows northnorthwest drift for the current, so it is difficult to say where this buoy might have come from.

If you wish to communicate further on this, I will list my address. If you happen to mention this in the Log, I would be pleased to receive a copy. Over a number of years I have always found the Log very interesting and informative. The above incident certainly confirms this.

This vessel is a British Voluntary Observing Ship as you will see from our weather reports. We also participate in AMVER.

With best wishes,

Captain E.H. Gregson
M.V. ORBITA
Pacific Steam Navigation Company
Wheelwright House
157 Regent Road
Liverpool, England L5 9YF

SHIP ENCOUNTERS EDDIES

The following interesting correspondence between Robert Baskerville, PMO, New York, and M. Horjus, Master of the OLEANDER, was forwarded to me by Mr. Baskerville. The letters concern the OLEANDER's encounter with rough sea conditions in mild weather as they passed through or near two cold cyclonic eddies on the east side of the Gulf Stream. Bob sent the Master a copy of the June 18, 1980, Gulf Stream analysis produced by the National Environmental Satellite Service (figs. 40 and 41).

New York, June 19, 1980

Mr. Robert W. Baskerville, Jr.
Port Meteorological Officer
National Weather Service, NOAA
New York, NY 10020

Dear Sirs,

On June 17, 1980, on our regular service from Bermuda to New York, course 317 degrees, speed 11.75 kn, we experienced very extreme water surface conditions in location 36°N, 68°W. This is 150 mi seaward of the northwall of the gulfstream.

As you will notice from the enclosed figure, from 1200 to 1600 hr, we experienced a strong easterly set, caused by unexpected current. During this time winds were from the southwest, force 4, slightly rolling ship.

After 1600 hr, rolling increased all of a sudden to very heavy 35 degrees to each side, and at 1640 hr we had to adjust course to 303 degrees to try to stay away from too heavy rolling. At 1900 hr, this heavy rolling diminished abruptly and course was set again to 317 degrees.

From 1600 to 2000 hr, we gained 8 mi on distance.

Apparently, we passed the right side of a small and strong cold eddy.

Please send us a fotocopy of a satellite-observed analysis of the gulfstream of this date to enable us to verify this. We do not have a weather satellite receiver system on board.

Thanking you in advance, I remain,

Yours faithfully,

M. Horjus
Master, cmv OLEANDER
c/o Norton, Lilly & Co.
Bermuda Container Line
90 West Street
New York, NY 10006

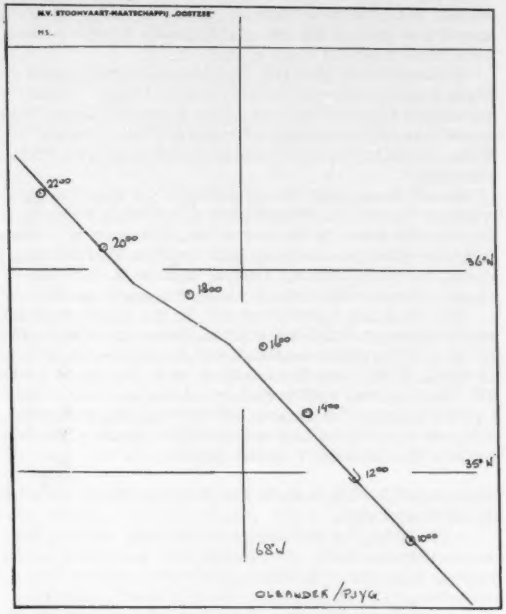


Figure 40.--The track of the OLEANDER.

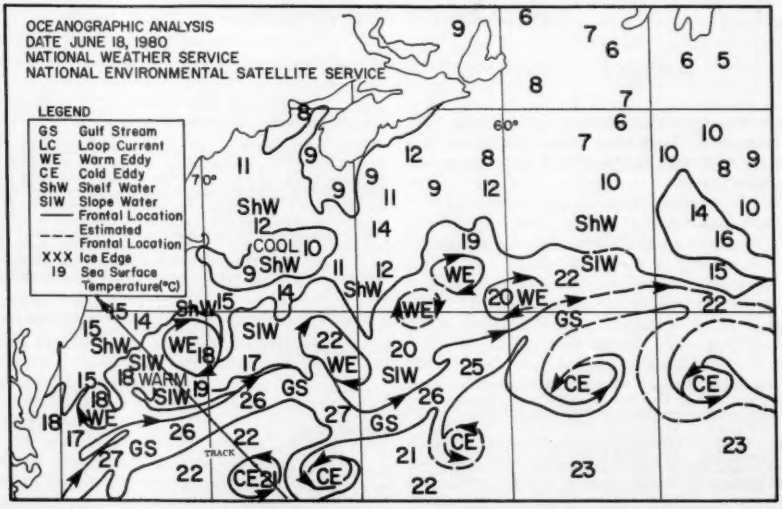


Figure 41.--The Gulf Stream analysis produced by NESS for June 18, 1980.

MARINE WEATHER REVIEW

The Smooth Log (complete with cyclone tracks, climatological data from U.S. Ocean Buoys, and gale and wave tables) is a definitive report on average monthly weather systems, the primary storms which affected marine areas, and late-reported ship casualties for 2 mo. The Rough Log is a preliminary account of the weather for 2 more recent months, prepared as soon as the necessary meteorological analyses and other data become available. For both Smooth and Rough Logs, storms are discussed during the month in which they first developed. Unless stated otherwise, all winds are sustained winds and not wind gusts.

Smooth Log, North Atlantic Weather

March and April 1980

SMOOTH LOG, MARCH 1980--This was a maverick month as far as matching climatology was concerned. The best match with the storm tracks was from the central United States northeastward across the Maritime Provinces. The storm tracks over water were widely diffuse. The most prominent track was from off the U.S. East Coast eastward to the United Kingdom. There were many minor tracks including over the Labrador Sea, over the Denmark Strait, Cape Race to Iceland, into the Iberian Peninsula, and over the Mediterranean.

The climatic sea-level pressure pattern shows the Icelandic Low southeast of Kap Farvel with a minor Low near Nordkapp. The Azores High is far south near 27°N, 35°W. This month the Icelandic Low at 1007 mb was over southern Iceland with a secondary 1010-mb Low south of Cape Race. The Azores High at 1022 mb was centered near 30°N, 30°W (fig. 42).

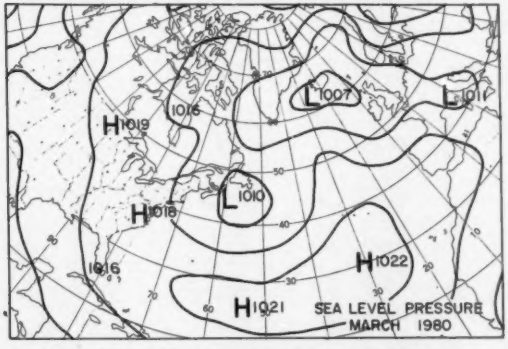


Figure 42.--March sea-level pressure chart.

The anomaly that was most indicative of this month's weather over the primary shipping lanes was a plus 9-mb center near 50°N, 30°W. Western Europe was host to the largest and deepest negative anomaly center of 5 mb.

The upper-air pattern at 700 mb was a very close match to climatology. The primary low center was over Baffin Island with a long-wave trough south from Cabot Strait. Several minor troughs over Europe formed that long-wave trough with more ridging than usual over the central ocean. These features were reflected by a positive anomaly center over the central ocean and a negative one over Europe, matching the sea-level anomaly pattern.

During the first 2 weeks of the month, the Azores High was normally located with the cyclones traveling northeastward over the western and northern oceans. The third week of the month the High pushed northward over Greenland with the cyclones traveling a southern track. The fourth week the High moved over the Sahara with little influence over the shipping lanes, except the Mediterranean Sea.

Extratropical Cyclones--The first storm was over Newfoundland on the 1st. There were some 40-kn gales. The front had just passed the GULF TRADER (36°N, 60°W) and had only 25-kn winds, but she was slammed by 33-ft swells. At 1200 the storm's pressure had plummeted to 959 mb off Hamilton Inlet. There was a report of winds of 50 kn from the northern tip of Newfoundland. On the 2d the OSA OSTEND at 47°N, 49°W, found 45-kn winds with 33-ft swells. At 1200 the swell waves had increased to 39 ft. The winds were generally in the 40-kn category. On the 3d the storm was moving through the Davis Strait and out of range of most ships.

Monster of the Month--A series of frontal waves moved across Florida from the Gulf of Mexico on the 1st. This one persisted as it reached the Gulf Stream. Late on the 2d the AMERICAN HERITAGE at 37°N, 72°W, encountered 33-ft swells out of the northeast. At 0000 on the 3d the MOBIL LUBE and USNS MAUMEE were both near 35°N, 75°W, with 45-kn gales and waves as high as 25 ft. In 12 hr the central pressure plunged 20 mb to 972 mb near 35°N, 70°W. Two ships

south and west of the center had 50-kn winds. The ANCHORAGE and MORMACSKY both had waves over 40 ft, with the latter reporting 70-kn winds. The GYPSUM BARON called the winds 78 kn near 36°N, 75°W, and the EL PASO ARZEW (32°N, 70°W) estimated they were 63 kn. A U.S. ship was pounded by 43-ft waves on the 4th.

This storm gave the Eastern Seaboard a rough time. Ports from Wilmington, N.C., to Norfolk, Va., were closed due to heavy snow and high winds. Winds over 60 mi/h hit the ports with snow depths over 2 ft. Elizabeth City, N.C., had 25 in on the ground. Norfolk, Va., had 14 in. Hundreds of cities in the eastern third of the nation south of latitude 40°N set new record cold temperatures. The U.S. Coast Guard was very busy with many ships in distress. The 3,018-ton MOUNT HORIZON was last sighted near 25°N, 79°W, on the 1st. A U.S. Navy vessel found lifeboats from the ship near Cape Hatteras on the 5th. The following ships (in no particular order) had damage or other heavy-weather problems. The tug FREDERICK E. BOUCHARD parted tow with barge No. 125; the SEA-LAND VENTURE lost her rudder, and the tug PATRICK R. MCALLISTER tried to assist and also lost her rudder; the HEIDE MORAN towing the BAY STATE parted tow; the HEROIC and RIO AMAZONAS had cargoes shift in 25-ft seas and 45-kn winds; tug MEDALIE B. was disabled; ROBERT CRAIG broke her mooring at Norfolk; the ABUL KALAM AZAD, SOUTHWEST CAPE, and the DRAKE SEA broke main masts; and the CORREGIDOR suffered damage. The 180-ft CGC CONIFER fought 50-kn winds and 50-ft seas to reach the RIO AMAZONAS with 34 people aboard.

The 0000 analysis of the 5th indicated the 980-mb LOW at 44°N, 52°W. A new center had formed 300 mi to the north-northeast and on the 1200 analysis was the only center left. On the 6th this LOW was 966 mb, and OWS Charlie measured 45-kn winds and 26-ft seas. The storm generated winds over 40 kn and waves up to 25 ft as it passed south of Iceland. On the 7th both Lima and Romeo had 30-ft seas. Ships off Lands End were finding winds over 50 kn and waves up to 40 ft. The CLAN MACGILLIVRAY (49°N, 08°W) reported 70-kn winds, 33-ft seas, and 49-ft swells.

The 7,706-ton GRACE FIVE suffered heavy-weather damage and crew injuries on the 6th and 7th. The 18,048-ton tanker TANIO broke in two early on the 7th off Ile de Batz. As the storm moved over the North Sea, it dropped from the race.

This storm came out of the central United States. It moved across the Great Lakes on the 5th. On the 6th and 7th there were isolated gale reports as it moved toward Greenland. At 1800 on the 7th the storm was near Kap Farvel. The CAST SEAL (50°N, 36°W) was slammed by 80-kn winds and 20-ft waves. The BRUARFOSS (52°N, 42°W) fought 60-kn westerlies. At 1200 on the 8th a Danish ship south of Iceland found 60-kn winds. Lima had 45 kn and 26-ft seas. The LOW moved against the Greenland coast on the 9th and circled back south of the Denmark Strait, where it remained stationary on the 10th, 11th, and 12th. Several transient LOWs moved into its zone of influence during this time, and the winds increased to 50 kn and more with waves over 20 ft.

In the middle of the month high pressure dominated the central ocean. There was a large cyclone that moved over the Labrador Sea, but according to the available reports it only produced gales. During the third week this high pressure moved northward over Greenland and Iceland. At the end of this week small LOWs occupied the area between Newfoundland and Spain. Low pressure was the predominant feature over the Mediterranean. At the beginning of the fourth week a strong LOW moved off the U.S. East Coast.

This was that storm. It originated over the high plains east of the Rocky Mountains. The center crossed Long Island at 0600 on the 22d. Winds of 50- to 60-mi/h hit the U.S. East Coast from Virginia north to Massachusetts. A Navy ship was off Nantucket with 42-kn winds from the east. Buoy 41001 measured 44-kn winds and 25-ft waves and 44004 measured 47 kn and 28 ft. On the 23d several ships had winds over 50 kn from near Cape Hatteras to Miquelon Island. At 1200 the VASYA KOROBKO (46°N, 48°W) radioed winds of 64 kn out of the east. The gradient at this time was tighter to the north as a second center had formed. The PIONEER CONTENDER, 350 mi east of Norfolk, had 50-kn winds, 20-ft seas and 30-ft swells.

On the 24th the two centers were circling each other. There were many reports over 40 kn. The CUMBRIA had the highest of 52 kn with 30-ft seas and swells, while 375 mi south of Cape Sable. Several other ships had waves near 25 ft.

On the 24th the first center surrendered, and the second one took over. There were several changes in centers of circulation as the storm continued eastward. There were isolated 50-kn wind reports on the 25th. Swell waves north of the center were as high as 25 ft and as high as 33 ft south of the center.

On the 26th at 1200 the 984-mb storm was 350 mi off Bishop Rock. A 980-mb LOW was trailing about 500 mi behind, and a 990-mb LOW was 600 mi to the north. These and a LOW southeast of Newfoundland were all part of a large cyclonic system. Wind reports near the Bay of Biscay were in the 40-kn range. At 1800 on the 27th the LOW was 991 mb near 57°N, 02°E. The winds over the North Sea were reported up to 52 kn with 10- to 20-ft seas. The MATCO AVON at 59°N, 02°E, had the highest of 52 kn and 20 ft.

At 1759 the platform EKOFISIC reported the accommodation platform ALEXANDER L. KIELLAND (56° 28'N, 03°07'E) was listing 50° and in danger of sinking. Twenty-two minutes later at 1821 the KIELLAND reported she was sinking and requested help. The wind was reported as 55 kn from 125°. Later an aircraft reported the waves were 25 ft. One of five legs on the platform had failed. Of the 212 persons on the KIELLAND, only 89 were rescued. The platform turned upside down with four of the legs showing above the water.

On the 28th this LOW disappeared over the Norwegian Sea and the following LOW kept bad weather in the area hindering rescue operations.

The initial LOW formed over the New Mexico-Arizona border. Three days later it crossed the U.S. coastline near Ocean City, Md. At 1800 on the 25th the first gales with this storm were reported. The HUMACAO (38°N, 73°W) found 45 kn and 21-ft waves. Several ships were finding waves near 20 ft. On the 26th this storm also made a switch of centers. During this period the winds were relatively weak. On the 27th the maximum winds were near 40 kn and waves 25 ft.

Late on the 27th the weather started to worsen. On the 28th the AMERICAN ARCHER (41°N, 55°W) found 55-kn winds with 31-ft seas, and the radio report indicated 57-ft swells. The weather observation log received by mail verified the extremely high swells. The SEATRAIN BUNKER HILL reported seas of 39 ft near 41°N, 44°W, at 1200. Also, the BIOKOVO, northwest of the center, called the winds 68 kn with 33-ft seas.

There was another switch of circulation centers on the 29th. At 1200 the new center was 986 mb near 36°N, 42°W. The FEDSTEEL (34°N, 41°W) near the center had 58-kn winds. The waves had been near 30 ft earlier. The winds slackened on the 30th, but there were swell waves around 20 ft. The AMERICAN ARCHER found 30-ft waves. On April 1 the LOW moved into the English Channel.

This potential storm formed directly over Cape Hatteras on the 29th. At 0000 on April 1 the storm was 998 mb near 45°N, 49°W. At 0600 the Canadian station CG26 near 46°N, 60°W, reported 45-kn winds from the north. At 1800 two ships, the ALGENIB (49°N, 41°W) and the FRITHJOF (54°N, 36°W), both had 50-kn winds with the former reporting 23-ft waves. The SURENES (46°N, 37°W) estimated 44-kn winds with 33-ft swell waves on the 2d near the front. At 1200 the 976-mb LOW was about 250 mi south of Kap Farvel. The AMERICAN LEGACY was near the southern edge of the circulation, 52°N, 40°W, with 40-kn winds and 20-ft waves. The LOW stalled south of Kap Farvel on the 3d, and a Soviet ship near 50°N, 44°W, reported 55-kn winds and 18-ft seas.

Casualties--These four ships had weather problems on the 1st on the eastern Mediterranean--the ALZAHRAA and COMARA contacted at Alexandria; the tug WIMPEY SEALION had her tow part in Port Said Roads; and the ZEUS sank about 120 mi off Cyprus. On the 6th the DONA PAZ (16,244 tons) dragged anchor in New York harbor. The 998-ton SUNNY L. had rudder damage in a storm off Algeria. The ALCHIMIST ROTTERDAM had to return to port after sustaining steering gear damage in a severe storm off Corsica on the 8th and 9th. The night of the 9th the 31,214-ton OLGA TOPIC and the tug STACEY BENDY collided in fog in the Houston ship channel.

The CARLANTIC had heavy-weather damage on the 9th and deviated to Lisbon for repairs. The ARTEMIS sustained damage at Bilbao, where weather repeatedly slammed her against a pier on the 8th. The ROTTERDAM also suffered minor damage.

The 2,469-ton MAURICE DESGAGNES developed a list in heavy weather 60 mi southeast of Halifax. The crew of 22 abandoned the ship, which sank on the 12th, and were rescued by the Canadian destroyer HURON. The 15,131-ton BAYAMON sustained heavy-weather damage on a voyage from New York to San Juan. The Greek TITHIS lost anchor and chain at Algiers about the 14th.

The 3,513-ton MARIA had to return to Bilbao on the 14th due to severe weather. The TUSKAR 2 capsized in heavy weather in the Westerschelde. The SEATRAIN BUNKER HILL arrived New York on the 18th and reported losing containers overboard. The 9,088-ton VALIANT arrived Baltimore on the 22d with weather damage. The 2,156-ton TURHAN BORAY capsized in heavy weather on the 27th and grounded near Antalya. Two crewmembers were missing. The GERMA GEISHA (5,300 tons) developed a list with a load of grain and sank off the Isle of Wight on the 30th. The 29,763-ton HELENUS broke adrift from a berth at Sheerness in 55-kn gusty winds and struck other ships. The VENI arrived Genoa on April 1 with weather damage.

The EXXON BALTIMORE and the steamboat NATCHEZ collided in heavy rain and fog on the 29th at New Orleans. The tanker SPETSAI arrived Bermuda on the 29th with weather damage.

The following vessels had problems in ice. The RALPH MISENER was holed by ice near Three Rivers. The SARONIC SEA anchored west of Quebec when the engine's sea suction pipe became fenced with ice. Two ferries with 268 people (MARINE ATLANTICA and the FREDERICK CARTER), the JOPA F., and the icebreakers LOUIS ST. LAURENT and LABRADOR all had been stuck in ice for 4 days on the 27th 10 mi outside Sydney harbor. An emergency airlift of food was made to the ferries. In Europe the EDUARD KAHLER, FEDERAL CLYDE, and NORA HEEREN had ice damage.

Late reports. The AMERICAN ACE bound for New York lost containers overboard. The NEU-ULM encountered heavy weather from the 18th to 24th from Three Rivers to La Guaira. The CATHERINE encountered heavy weather March 28 to April 6 from Rotterdam to Philadelphia with damage. The GOLDEN LILAC suffered hull damage at Sinoe, Liberia, due to heavy swell during the 28th to 30th. The tanker SPETSAI arrived Bermuda on the 29th with heavy-weather damage to her hull.

SMOOTH LOG, APRIL 1980--This was an anomalous month over the North Atlantic. Neither the storm tracks nor the mean pressure pattern resembled climatology. Normally, there are two major storm tracks: one from the Great Lakes to Newfoundland where one branch splits into the Labrador Sea and the other continues eastward; and the second from off Norfolk to the Denmark Strait. This month there were a large number of storms over northern Canada. The Great Lakes Basin was a favorite area for cyclones, but they traveled in multidirections. Three storms approximated the climatological track along the U.S. East Coast toward the Denmark Strait. One of the busiest areas was the central ocean near the Azores.

During most of the month there was high pressure west of the English Channel. This was reflected in the mean sea-level pressure by an anomalous 1027-mb HIGH near 51°N,16°W, and in the sparsity of observations over that part of the ocean and the LOWs near the Azores. The normal 1021-mb Azores High was shifted about 900 mi to the west near 30°N, 48°W. The Icelandic Low (1006 mb) was displaced from near Kap Farvel to the Greenland Sea with a second 1007-mb Low west of Iceland (fig. 43).

The primary feature on the sea-level anomaly chart was a plus 13-mb center west of Ireland. Higher-than-normal pressure dominated the latitude belt between 40° and 60°N, with a plus 8-mb center off Cape Race. There were two significant negative centers, a 5 mb over the Greenland Sea and a 4 mb over the central ocean near 34°N, 30°W.

There were also major differences from climatology in the upper air. The most prominent anomalous

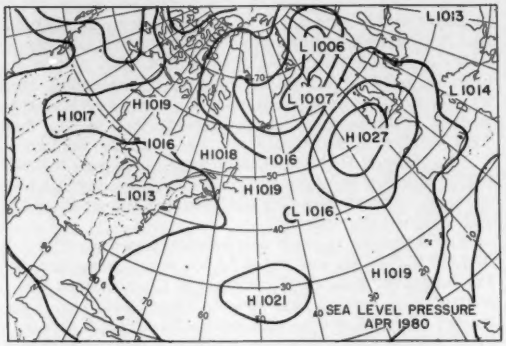


Figure 43.--April sea-level pressure chart.

feature was a high center off Lands End reflecting the surface High. The normal trough off the East Coast was retrograded to the Great Lakes-Mississippi River area.

There were no tropical storms this month, and none would be expected.

Extratropical Cyclones--This was a rather quiet month with few severe storms. The anomalous high-pressure center west of Europe directed many storms far to the north and allowed some to form south and west of the Azores.

On the 1st there was a LOW off Norfolk. A ship near Cape Hatteras had 45-kn westerly winds. Also, the MARIAS TAO-57 at 37°N, 66°W, measured 53-kn winds from the northeast with waves of 15 ft. By the 2d the storm had moved to 38°N, 50°W. The TEMSE had 26-ft swell waves near 35°N, 54°W. On the 3d there was high pressure over the Bay of Biscay, and the storm turned toward the northeast. The SEA-LAND VENTURE (42°N, 36°W) had 50-kn winds and 36-ft waves. Other ships were finding gales in the southerly flow. By midday on the 4th the LOW abruptly disappeared.

This LOW formed north of Quebec in a col area between two HIGHs on the 2d. It moved southeastward and over water as a very weak circulation until the 4th, when it suddenly deepened and turned eastward. It dropped 14 mb in 12 hr. At 1200 and again at 1800 three ships had winds over 60 kn. They were the SURENES (40°N, 51°W) with 46-ft swell waves, the ANCO CHALLENGER (43°N, 48°W) with 33-ft seas, and the YTNW which had the highest winds of 68 kn and 20-ft waves.

On the 5th several ships had winds near 50 kn. The RAVENSWOOD (37°N, 42°W) had 44-kn winds with 39-ft swells. The SEA-LAND CONSUMER (36°N, 43°W) had winds of only 40 kn, but the seas were 41 ft. The storm now turned southeastward again as a 1038-mb HIGH was centered over England. The storm was weakening on the 6th. It almost disappeared on the 9th, but it turned northward as high pressure moved eastward over the Continent. Although the LOW deepened only slightly as it moved northward, it managed to survive into the 13th.

This storm came out of the Midwest and crossed the Great Lakes on the 4th. On the 5th the southerly flow was off the coast and the LASH ATLANTICO had 45-kn gales off Norfolk. At 1200 the LUGWIGSHAFEN EXPRESS (37°N, 65°W) found 55-kn southerly winds and 30-ft swells east of the front. The LABRADOR (46°N, 60°W) had 52-kn southeasterly winds. The storm turned northward as high pressure blocked further eastward movement. On the 6th the FYLLA (61°N, 48°W) had 60-kn easterly winds. On the 8th the storm was traveling through the Davis Strait. The GRONLAND found 44-kn winds and the KUNUNGUAK (66°N, 54°W) had 52-kn winds with 20-ft seas. Later in the day the storm broke into multiple centers.

This LOW split off on the southeast coast of Greenland from a LOW over the Greenland Sea. It drifted southward, widening its zone of influence. At 1200 on the 11th it was 990 mb at 60°N, 33°W. At 0600 that day OWS Lima had 44-kn winds from the south. The FYLLA, south of Frederikshab, in the northerly flow had 52 kn. On the 12th OWS Charlie had 40-kn winds and 21-ft waves. On the 13th the storm was on a northerly track and the RIGG east of the Shetland Islands measured 52-kn winds. As the storm crossed Iceland, it picked up speed and was over northern Greenland on the 15th.

A heat LOW near Monterey, Mexico, got a shove and raced across the Gulf of Mexico to near New Orleans at 1200 on the 13th. Thunderstorms along the front dumped heavy rain on the Texas, Louisiana, and Mississippi coasts on the 12th. Flooding caused by 5 to 9 in of rain washed out 30 railroad bridges in eastern Texas. On the 13th a severe thunderstorm produced a 103 mi/h wind gust near Gulfport, Miss., and the airport control tower was destroyed. The buoys in the Gulf were reporting 20- to 30-kn winds. Late on the 13th the PURE OIL at 27°N, 90°W, reported northwesterly winds of 58 kn behind the cold front. She was reporting squalls at the time. On the 14th a station off Yucatan reported 40-kn winds. The LOW was moving northward across the Great Lakes on the 15th. On the 16th the JOHN DYKSTRA measured 45-kn winds in the northerly flow over Lake Huron.

Michigan produced this storm. On the 14th it was over the Gulf of St. Lawrence. As it moved over open and warmer water, it intensified rapidly. At 1800 the A.T. CAMERON on the Grand Banks had 55-kn winds. Several other ships had winds in the 40's. By 0000 on the 15th the LOW was 980 mb near 45°N, 47°W. The TFL DEMOCRACY (45°N, 46°W) measured 45-kn winds. The WVFN located 42-kn winds. The winds and waves were picking up. The FRANCISZEK ZUBRZYCKI and ATLANTIC CAUSEWAY both had 50-kn northwesterly winds with the former fighting 30-ft waves. Forty- to fifty-knot winds and waves up to 25 ft continued into the 16th.

At this time high pressure was moving northward off Portugal, and the LOW turned southward. On the 17th the storm was weakened considerably as the HIGH built to 1040 mb off Ireland. It no longer existed on the 19th.

This was another LOW that formed over the east coast of Greenland in the backwash of another storm. It was 986 mb on the first analysis on the 17th. The large HIGH mentioned previously was centered on latitude

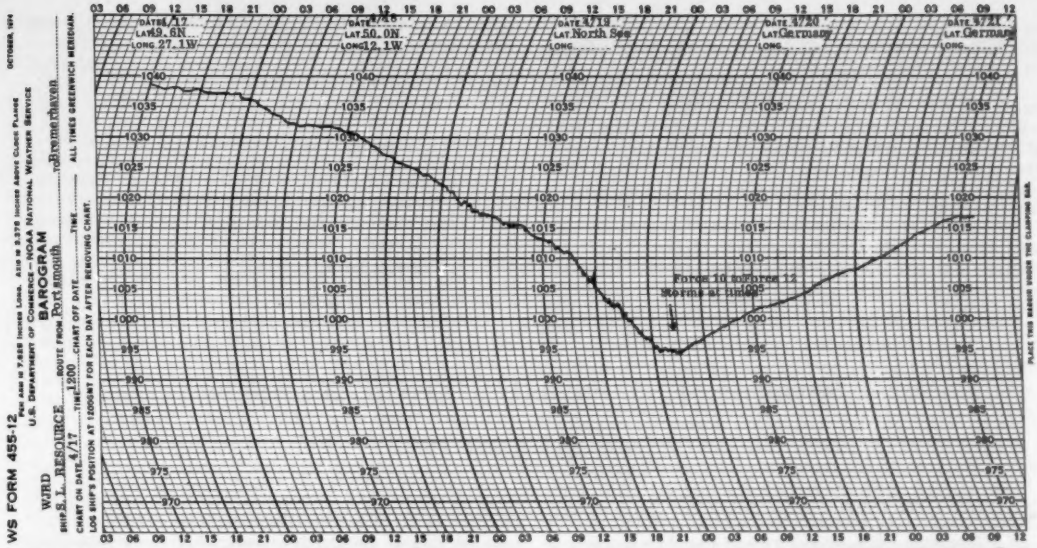


Figure 44.--The barogram of the SEA-LAND RESOURCE gives an indication of the depth and strength of the storm.

50°N between Cape Race and Lands End. At 1200 on the 18th the storm was 972 mb near 74°N, 03°W, with gales. On the 19th a second center joined the overall circulation over Sweden. Strong cold winds were pouring down from the Arctic over the Norwegian and North Seas. Platforms and ships were finding winds ranging from 40 to 60 kn. The POLARSIRKEL had 60-kn winds below minus 5°C for over 12 hr in the vicinity of 74°N, 08°W. The waves increased rapidly with many of the platforms having waves near 30 ft. One at 64.3°N, 2.6°W, had 54-kn winds and 43-ft waves. Another at 60.8°N, 1.4°E, had 50-kn winds and 49-ft waves.

By 1200 on the 19th the southern LOW was the major circulation at 960 mb and the original LOW was fading. The SEA-LAND RESOURCE (fig. 44) was sailing into Bremerhaven on the 20th when her pressure reading dropped to 994 mb and she suffered force 10 to 12 winds as noted on the barogram. A British reporter called the winds 58 kn and the seas 30 ft, but they were subsiding as the storm traveled southeastward and then northeastward. On the 21st it was back over the Arctic Ocean.

The northerly winds with this storm resulted in one ship sinking, several damaged with damage to locks and dolphins in the Kiel Canal, and coastal damage in the Netherlands. The ALTMARK sank off Rotterdam after shipping water through a broken hatch. One crewman died, one was missing, and three were rescued by helicopter. Ships with problems in the Kiel Canal were the JOH GORTHON, DENIZATI, INOWROCLAW, LEOPOLD STAFF, and JUNIOR LILIAN.

This storm was the product of several LOWs, one of which was a subtropical LOW which formed off Cape Kennedy on the 20th. As it drifted northward and eastward, several other centers materialized. On the 23d yet another center was found off Cape Cod which was to become this storm. Ships identified as VC24 and CG11 near Nova Scotia had 45-kn winds from the east at 0600. The CHERRY (40°N, 56°W) had 52-kn winds, and the SNOW BALL (39°N, 50°W) had 23-ft waves. On the 24th at 1200 the circulation had completed its consolidation into one center. The HUDSON (46°N, 57°W) found 48-kn winds. A ship south of the center had 40 kn and 20-ft waves. From now until the 28th it appeared that the storm would dissipate, but that day it revived. A ship at 48°N, 40°W, had 40-kn winds and 23-ft seas. On the 30th a British ship found 23-ft swells in the southerly flow, but the storm center was gone the next day.

On the 28th a weak LOW moved over the Cape Hatteras area and several waterspouts were sighted off the coast during the afternoon.

Casualties--This was the month for ice damage. In the early morning of the 2d the Liberian 35,450-ton AMOCO CREMONA and the American 7,189-ton MASON LYKES collided in fog near the entrance to Galveston Bay. Both vessels caught fire. The crew of the AMOCO CREMONA abandoned ship but later reboarded and extinguished the fire. The Greek ION encountered heavy weather on the 4th and diverted to Norfolk. The Danish JUNIOR LONE struck ice and damaged her hull on the 6th at Baie Verte, Newfoundland. Wind, waves, and ice forced the COURTNEY BURTON to broach toward the Duluth ship canal breakwall approaching Duluth harbor on the 8th. The severe conditions prevented tugs from helping, and she dropped anchor. The Dutch LOOSDRECHT reported heavy weather damage at Saint John, New Brunswick, on the 7th.

On the 10th the Yugoslavian BANIK and the FANTI collided during a strong gale at Guyana. On the 11th the 748-ton CAPE D'OR was holed by ice and sank near 53°N, 52°W. The trawler CAPE LA HAVE was holed

by ice off Labrador on the 12th. The Canadian Coast Guard dropped pumps, and the vessel was able to make St. John's, Newfoundland.

The CHICAGO TRIBUNE (3,595 tons) encountered heavy ice near Whitefish Point on the 13th, which caused slight cracks in her bow. The 19,160-ton RALPH MISENER also suffered ice damage from a large ice floe while departing Quebec--day unknown. The 2,272-ton FORTUNA REEFER suffered heavy weather enroute from Savannah to Montevideo.

The bulkcarrier MEDSTAR put into Cadiz on the 16th with weather damage. The 4,145-ton Egyptian AL KAHERAH encountered bad weather with internal damage which was reported at Alexandria on the 24th. Late in the month the PAUL H. TOWNSEND responded to a distress signal from the fishing tug JENNY LOU on Green Bay. The tug's engines had failed to start in strong seas. The TOWNSEND shielded the tug from the seas until the USCG MOBILE BAY arrived.

Other Casualties--The MAURITIUS II sank on the 17th off Durban. The crew was rescued by the ALFA-RAHIDI. The vessel apparently encountered "Cape Rollers" in the Agulhas Current. A number of trawlers and fishing vessels were damaged in strong currents in the River Quequen, Buenos Aires, after torrential rains. Also, the LADY SOPHIE apparently suffered cargo damage. The South Korean WOLJONG grounded in strong winds in the Gulf of Aqaba.

Smooth Log, North Pacific Weather

March and April 1980

SMOOTH LOG, MARCH 1980--Many of this month's storms had long histories and tracks. The storm tracks generally followed the climatological tracks. The primary track was from Japan eastward to the central ocean and then northeastward into the Gulf of Alaska. There was a branch of this track which turned northward into the Bering Sea. There was also a track out of Asia across Sakhalin Island toward the Bering Sea. The major difference between the actual tracks and climatology was the absence of a major track onto the British Columbia-Washington coast.

The mean sea-surface pressure pattern (fig. 45) also was a close match with its climatic counterpart, except the pressure centers were more intense. The Aleutian Low at 993 mb was centered near 54°N, 178°E, versus 1005 mb near 49°N, 170°E. The 1029-mb Pacific High was near 33°N, 146°W, very near its 1022-mb climatic counterpart.

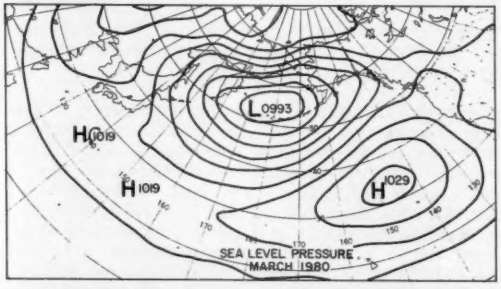


Figure 45.--March mean sea-level pressure.

The anomalies were closely collocated with the pressure centers. A negative 15-mb center was near 57°N, 176°W, not far from the Pribilof Islands. A plus 7-mb center was at 37°N, 149°W.

In the upper air at 700 mb there were two centers, rather than the normal one center over the Sea of Okhotsk. They were just east of Kamchatka and at 180° about latitude 55°N.

The climatic wave chart shows an area east of Mys. Lopatka with a 10-percent chance of waves greater than 20 ft. The 5-percent frequency isoline covers a large area off Japan, the Kurile Islands, and the southwestern Bering Sea.

There were no tropical storms this month. The first one of this year has yet to form.

Extratropical Cyclones--This storm came off the Asian continent on the 1st. At 0600 the ANCO TEMPLAR had 50-kn southwesterly winds just prior to frontal passage near 33°N, 137°E. The waves were 26 ft. The SEAWAY EXPRESS was sailing on the Japan Sea with winds of 47 kn and seas of 16 ft. At 0000 on the 2d the storm was 972 mb near Ostrov Urup. At 40°N, 148°E, the SHINZUI MARU reported 78-kn winds with 30-ft waves. Several other ships in the southwest quadrant were hit by winds of 50 kn or more. Two of the Kurile Islands measured winds near 40 kn. At 0600 the PRESIDENT KENNEDY estimated the winds at 60 kn near 42°N, 151°E.

The EASTERN MOON was doing a fine job of reporting and on the 3d had 50-kn winds with 25-ft waves at 44°N, 163°E. Another ship closer to the LOW had 33-ft swell waves. The LOW was over the Bering Sea on the 4th. The winds had quieted down, but 20- to 25-ft waves were still around as found by the MARSEILLE on the 4th and 5th. The LOW disappeared over Saint Lawrence Island on the 6th.

A Tehuantepecer. On the 1st at 1200 the analysis showed a front along the U.S. Gulf Coast with a 1049-mb cold HIGH centered west of Minneapolis, Minn. The gradient over the Gulf of Mexico was very weak with generally southerly winds. Within 12 hr the front had plunged past Veracruz on the Mexican coast, where it slowed in its southerly movement. The cold air piled up against the mountains of southern Mexico prior to spilling over the Isthmus of Tehuantepec into the Gulf of Tehuantepec. At 1800 on the 2d the DELTA AFRICA (16°N, 94°W) reported 65-kn winds from due north and at this time the waves were only 8 ft. At 0600 on the 3d three U.S. Cooperative ships mailing in reports had both high winds and waves. They were the AMERICAN LIBERTY, 45 kn and 25 ft; the OVERSEAS JUNEAU, 60 kn and 30 ft; and the WALTER

RICE, 55 kn and 17 ft. They were sailing between 13°N and 16°N and 94°W and 96°W. At this time the center of the HIGH was 1033 mb near Houston. A few hours later the HIGH weakened and retreated northeastward. This relieved the pressure over the Gulf, and the winds over the Gulf of Tehuantepec returned to normal.

This storm formed in an inverted trough over Kyushu on the 7th. By 0000 on the 8th it had developed into a 988-mb storm off Tokyo with many ships involved. The PEDRO-N (36°N, 141°E) found 60-kn winds. The AMERICAN LANCER nearby had 60 kn with other ships close to these speeds. One ship had 28-ft seas.

The storm was racing eastward, and the TESIRO I (33°N, 150°E) had 50-kn winds and 28-ft swell waves. The storm continued to sweep eastward with only minimal gales and almost vanished from the analysis as it moved over top of the Pacific High. Late on the 12th, it suddenly intensified off Vancouver Island. At 0000 on the 13th the 976-mb LOW was 250 mi west of Cape Flattery. The AMERICA SUN was only about 60 mi south of the center with 55-kn winds, 25-ft seas, and 30-ft swells. A Japanese ship 40 mi farther south had 60-kn winds. At 1200 the storm moved on shore.

The 11,559-ton PRESIDENT WILSON enroute to Dutch Harbor diverted to Seattle with damage to foredeck containers and structural damage. The 20,187-ton FALSTRIA enroute to Seattle lost 12 40-ft containers overboard and another 8 containers were lying on their side.

This LOW came out of China on the 8th. The storm paralleled the south and east coast of Japan. By 1200 on the 10th it was 976 mb east of Hokkaido. The SILVER STAR had 60-kn winds and 26-ft waves at 0000. During this storm on the 10th, 11 U.S. Cooperative ships mailed weather observation forms to the National Climatic Center with recorded winds greater than 40 kn. The WASHINGTON WOOD measured winds of 60 kn with 36-ft seas near 41°N, 149°E. On the 11th the SUNNY PIONEER (43°N, 154°E) had 41-ft waves, and the PRESIDENT MADISON (42°N, 150°E) found 55-kn winds. The storm was 960 mb near 49°N, 151°E.
The BELLMAN (42°N, 146°E) was battered by 33-ft waves and 65-kn winds at 0600. Twenty-foot waves were as far south as latitude 34°N. The YOUNG SKY (45°N, 150°E) called the swell waves at 56 ft. Winds over 50 kn continued into the 12th, and the NATALIE BOLTEN (40°N, 147°E) had 39-ft swells. Several others had waves as high. There were still winds up to 50 kn and swell waves to 33 ft on the 13th, but they decreased late in the day with this center falling apart on the 14th.

This was a short-lived storm. It was first found as a frontal wave on the 1800 analysis of the 11th between a LOW over the south coast of Alaska and the Pacific High. The Pacific High was retreating southeastward and weakening as the storm moved over its top. By the 0000 analysis of the 13th the pressure had dropped to 978 mb off the Washington coast. It was a small but intense storm. Buoy 46005 measured 41 kn at 2300 on the 12th and 46 kn with 21-ft seas at 0200 on the 13th. At 0000 the AMERICA SUN about 300 mi west of Portland measured 56-kn winds with 25-ft seas and 30-ft swells. Three hundred miles south of the center another ship had 20-ft seas. By 1200 the storm's center moved over Vancouver Island and the next day was lost in the mountains.

Another storm from southern Japan. It also traveled east-northeastward, and by the 14th gales were blowing in the warm sector. At 0000 on the 15th the 980-mb storm was at 38°N, 152°E. Two American ships, the SEALAND FINANCE and PRESIDENT GRANT, were inside the 1000-mb line with 55- and 45-kn winds, respectively, and 33-ft swells. A ship farther south at the front had 34-ft swells from the south. At 1800 the EAGLE ARROW (40°N,167°E) reported 60-kn winds, and at 0000 on the 16th the NAIRNBANK (43°N, 175°E) had southerly 60-kn winds. The VAN WARRIOR (53°N, 171°E) was north of the center with a pressure of 976 mb, 55-kn winds, and 30-ft waves. Others were having waves over 25 ft. At 0000 on the 17th the storm was 952 mb at 50°N, 170°E. The higher winds were near 50 kn with waves near 30 ft, but at 1200 the TOYOTA MARU No. 12 (49°N, 158°E) reported 80-kn winds.

This was a large storm, and there were several troughs in the circulation. It was the only major low-pressure center north of latitude 20°N. Its circulation reached from Japan to British Columbia. Now the major problem seemed to be high waves. The MANHATTAN near Queen Charlotte Sound had 33-ft waves. The BUNGA MELAWIS in midocean had 30-ft waves. Small frontal waves were starting to form on the periphery. On the 19th the SIMBA (42°N, 177°E) measured 70-kn winds. The STREAM HAWSER measured 38-ft swell waves. One of the frontal waves quickly developed and by 1200 became the primary center of circulation. The sea state analysis indicated an area several hundred miles wide of seas greater than 20 ft near 50°N, 170°W. The fishing fleet along the Alaska peninsula was hard hit. Among others, the ALEUT PACKER radioed WBH-29 Kodiak of southeasterly winds of 50 kn gusting to 60 kn in Dutch Harbor. The KALUPEIO in Fox Bay reported 40 kn gusting to 60 to 70 kn. These high winds continued into the 21st, with the KIMBERLY and OCEAN BOUNTY calling the gusts up to 80 kn. On the 21st the PRESIDENT PIERCE was north of Umnak Island with 55-kn southwesterly winds, 30-ft seas, and 36-ft swells. The 966-mb center was near Saint Paul Island. The LOW started to rapidly fall apart on the 22d as it approached the Bering Strait.

This LOW came out of the central ocean east of the last LOW. At 0000 on the 16th it was 980 mb near 52°N, 158°W. The winds were in the gale category. At 1200 a ship near 52°N, 131°W, had 58-kn winds. At 0000 on the 17th possibly the same ship had 40-kn winds and 41-ft swell waves near 52°N, 130°W. On the 17th it stormed ashore.

A frontal wave came out of the Sea of Okhotsk on the 20th. It traveled southeastward, then turned northeastward on the 22d when it became a threat to ships. The PRESIDENT HOOVER found 33-ft waves near 35°N, 168°E. At 1800 the HARUNA MARU (42°N, 176°W) measured 56-kn winds. On the 23d a ship near 46°N, 170°W, reported 55-kn winds and 30-ft swells. The JAPAN ACACIA radioed winds of 50 kn with 30-ft swells. The storm disappeared over the Gulf of Alaska on the 25th.

Thus far this month four out of four storms that developed near Japan had been severe storms, and this one was no exception. It was also a rapid developer. Within 24 hr after its first analysis the LOW was 988 mb near 39°N, 150°E, at 0000 on the 23d. The ANCO SOVEREIGN (34°N,148°E) was sailing into 60-kn winds

and 41-ft waves. The OCEAN VENUS was sailing southward with 70-kn winds and 26-ft westerly waves against her starboard beam on the 24th. The LOW was now 960 mb at 0000. The HOEGH BULLAREN at 45°N, 175°E, had 60-kn winds and 26-ft waves at 0600. Wind reports over 50 kn continued into the 25th. The SANKOSUN at 48°N, 171°W, was battered by 39-ft waves. At that height they did not try to differentiate between sea and swell. The RED ARROW measured 55-kn westerly winds at 0600 near 49°N, 170°W, and reported the seas as 62 ft. The wind-wave analysis showed a large area of high seas centered on 48°N, 170°W, with a maximum of 27 ft. According to the analysis, seas over 20 ft covered an area bounded by latitudes 45° to 51°N and longitudes 163° to 177°W (fig. 46).

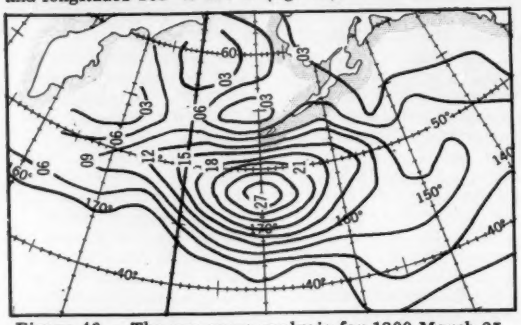


Figure 46.--The sea-wave analysis for 1200 March 25 shows seas higher than 27 ft.

The storm was now decreasing in size and intensity as it moved over Bristol Bay on the 26th. The RED ARROW (48°N, 164°W) was now reporting only 37-kn winds and 39-ft seas. There were several ship reports near 50 kn and wave reports of 33 ft south of the Alaska peninsula. Among these were the CRYSTAL STAR and VIENNA WOODS. The Alaska fishing fleet reported high winds and waves from the 23d to the 27th. The storm circled to the west and then south to dissipate.

Yet another severe storm from off the Japanese coast. It formed with a developing front on the 26th east of Tokyo. By the 27th ships were picking up strong gales. At 1200 the NEW GOLDEN PHOENIX (40°N, 164°E) had 48-kn winds about 200 mi southeast of the center. Winds in the gale range continued through the 28th with waves of 20 to 33 ft. The NEW GOLDEN PHOENIX was following the storm and had winds up to 55 kn and waves to 35 ft on the 29th. The LOW was 964 mb near 48°N, 174°W. At 1800 the OGDEN THAMES (45°N, 170°W) had 50 kn, 25-ft seas, and 33-ft swells.

On the 30th and 31st the LOW stalled near 56°N, 170°W. The PHILADELPHIA (55°N, 138°W) had southeasterly 60-kn winds with 20-ft seas and 28-ft swells. There were quite a few 20-ft wave reports. The Pacific High at 1039 mb was elongated north-south along 135°W early on April 1 and stubbornly resisting movement. The 986-mb LOW was weakening off Bristol Bay but there was a very tight pressure gradient over the Alaska and Kenai peninsulas. At 1200 the ALEUTIAN DEVELOPER measured 48-kn winds south of Middleton Island. That morning Anchorage and vicinity were hit by wind gusts clocked up to 130 mi/h (113 kn). Damage was estimated at $20 million. Mobile homes were demolished, trees uprooted, roofs ripped from homes, aircraft overturned, and vast electrical power outages. It appeared that the strong southerly winds were funneled through Cook Inlet and the Susitna River Valley causing a large increase in speed. By 0000 on the 2d this LOW was gone, but another was approaching from the west and yet another from the south.

This storm came out of Manchuria. At 1200 on the 30th it was over the Sea of Okhotsk with another center to the south of Honshu. The AKAISHI MARU found 50-kn winds and another ship 23-ft seas with this southern LOW. At first it appeared this would be the stronger storm, but late on the 31st the northern storm absorbed it. At 1200 Ostrov Matua measured 50-kn winds. Several fishing ships near the islands had winds near 50 kn. The PRESIDENT JEFFERSON located near 45°N, 154°E had 60 kn winds and fought 39- ft seas. On April Fools' Day the GOLDENROD had following 50-kn winds and 25-ft seas as she sailed northeastward along the Kurile Islands. The storm was traveling eastward north of the Aleutians on the 2d. The PRESIDENT ADAMS was near Seguam Island with 60-kn winds. The ALDGATE far to the south (44°N, 177°W) had 50-kn winds and 23-ft waves. The fishing vessel CLOVERLEAF sank 8 mi north of Sutwik Island. Two men were lost. On the 3d the storm disappeared.

Casualties--The 19,750-ton bulkcarrier ARIETTA was at Kawasaki on the 3d with heavy-weather damage. The Honduran LADY SOPHIE reported her hull had been holed and it was sinking 54 mi north of Rio Grande bar. Heavy deck cargo shifted in bad weather. She later arrived Rio Grande. On the 4th the 3,139-ton STRAIT CONTAINER grounded in fog at the eastern entrance to Hong Kong harbor. The RIO CUYAMEL requested a heavy-weather-damage survey on arrival at Yokohama on the 8th. The 15,980-ton SHUNWIND requested heavy-weather-damage survey at Kobe on the 15th.

The MALDIVE PIONEER was at Taiwan on the 18th with weather damage. On the 22d the 3,499-ton KAIFUKU MARU was hit by high waves and overturned near the mouth of Beppa Bay. Two of the four crewmen on board were killed. The GULF HAWK at Otaru on the 26th reported weather damage. The 10,369-ton SOKAI MARU sailed from Yokohama on the 30th, but returned on April 1 after the collapse of wooden car decks in heavy weather. Over 300 cars were damaged.

Other Casualties--The ACT 5 arrived Auckland with entire navigational aids including radars and satellite antennas severed by a Portainer. The IRON SIRIUS reported heavy-weather damage at Sydney on the 18th.

SMOOTH LOG, APRIL 1980--The storms crossing the ocean this month appeared to be deeper than normal and lasted longer. This is reflected in the strong Aleutian Low. Climatology indicates the primary storm path is from Japan to Bristol Bay. There is another track from Asia into the Sea of Okhotsk and yet another from south of the Fox Islands that forks into the Gulf of Alaska and Queen Charlotte Sound.

This month the primary track was from Hokkaido into the Gulf of Alaska, touching the Aleutians at the date line. At midocean, about 600 mi south of the Aleutians, a secondary track curves into the Gulf of Alaska. Several storms moved toward the British Columbia coast,

but were from the south rather than the west. None crossed into the interior.

The climatological normal sea-level pressure chart indicates four Low centers of 1009 to 1010 mb from the Kenai Peninsula to the Sea of Okhotsk. The Pacific High is elongated along latitude 30°N with a maximum pressure of 1023 mb. This month the mean analysis was more intense with one 994-mb Aleutian Low centered about 200 mi south of Kodiak Island. The 1027-mb Pacific High had its maximum pressure center at 32°N, 180°, 1,700 mi west of its normal location (fig. 47).

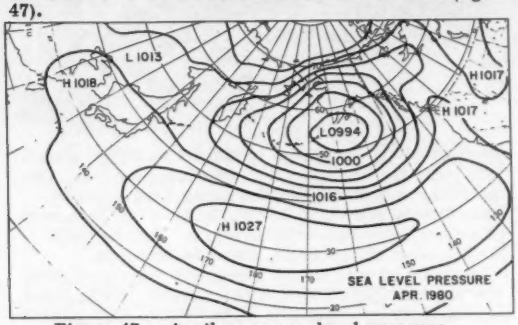


Figure 47.--April mean sea-level pressure.

There were two major anomaly centers: a minus 18 mb near 52°N, 155°W, and a plus 6 mb near 32°N, 177°E. A third anomaly center that could have affected this ocean's weather indirectly was a plus 13 mb over the Arctic Ocean near 79°N, 160°E.

There was also quite a difference in the upper air pattern at 700 mb. This consisted primarily of an anomalous deep Low near Unimak Island. This in conjunction with the 700-mb subtropical High being 64 m higher than normal produced a tighter gradient with higher windspeeds.

Tropical storm Carmen formed over the western ocean.

Extratropical Cyclones--This first storm of the month was analyzed off Honshu on the 1st. The SUNNY WEALTH north of the warm front reported 41-ft swell waves. The LOW was moving through the circulation of an older system along the Aleutians. On the 3d the SPRAY CAP (37°N, 167°W) reported 55-kn winds and a ship at the warm front had 20-ft waves. On the 4th she was west of the cold front with 58-kn winds. The SPRAY CAP was traveling with the storm, but being left farther behind. She had 50-kn winds on the 5th. The ALSATIA found 20-ft swell waves at 35°N. On the 6th the JAPAN ACE (44°N, 133°W) was south of the LOW with 45-kn winds and 26-ft waves. The MANHATTAN off Cape Flattery had 30-ft waves. The ATROPOS ISLAND farther west had 26-ft waves. On the 7th the storm died on the rugged coast as the QUADRA caught 68-kn winds off the coast.

This LOW appeared to burst out of nowhere into a full-blown storm late on the 6th. The 0000 analysis of the 7th showed a 980-mb LOW at 46°N, 172°W. Four ships had gales between 40 and 45 kn. At 1800 the HIRA MARU (41°N, 155°W) had 44-kn winds with 33-ft swell waves. During the day several ships had winds over 50 kn. The FORTUNSTAR (46°N, 157°W) measured 52 kn with 33-ft waves at 1700. At 0500 on the 8th she measured 58-kn westerly winds with 43-ft seas and swells. Most of the reported winds were in the 40-kn range with seas up to 21 ft. The sea-wave analysis showed an area of sea waves over 20 ft between 40° and 45°N and 150° to 155°W. The LOW was now 964 mb near 49°N, 157°W. The GLACIER BAY (46°N, 152°W) was behind the occlusion with 30-ft swell waves; 300 mi south a Japanese vessel had 33-ft swells. The LOW disappeared almost as fast as it grew and was gone by the 10th.

This LOW came out of the Sea of Japan and followed the LOW above. At 0000 on the 7th it was 992 mb near 46°N, 157°E. The SOUTH EXPRESS (36°N, 148°E) had 50-kn winds near the cold front with 20-ft waves. The PRESIDENT MADISON had 40-kn winds on the 8th. At 1200 the SHINSHO MARU (44°N, 164°E), about 450 mi southwest of the storm radioed 55-kn winds and 20-ft seas. Two ships had 50 kn on the 9th. At 1200 the SEA-LAND EXCHANGE was within 1 mb of the storm's center. The storm curved southeastward on the 10th and immediately started to weaken, but circulation persisted as it moved over the Pacific High. A secondary LOW formed in the northeast quadrant on the 10th and intensified as it moved northward. A strong pressure gradient developed in the eastern half between the front and a HIGH over the coastal mountains. The OGDEN THAMES was in this area off the Queen Charlotte Islands on the 11th and measured 48-kn southerly winds with 31-ft waves. Yakutat, Alaska, measured 41 mi/h winds with a peak gust of 48 mi/h. The LOW moved over the Alaska coast on the 12th and dissipated.

On the 13th the original storm turned northeastward and intensified. A ship near 32°N, 141°W, found 52-kn winds, and several others found 40 kn before the storm died out over Vancouver Island on the 15th. It had made the journey from coast to coast.

An inverted trough from Asia moved over Japan, and this LOW formed over the Kuroshio Current. By the 10th it was 990 mb off Ostrov Simushir. Several ships had gales, and the JAPAN ACACIA (42°N, 168°E) reported southeasterly 66-kn winds with 20-ft waves. The SILVER STAR was in the northwesterly flow (36°N, 148°E) and measured 60-kn winds driving 26-ft seas. On the 11th the pressure had continued to drop to 969 mb as the storm moved along the Kurile Islands. Many ships had gales with several near 50 kn, but high waves were their worst problem. The NEPTUNE EMERALD, NEPTUNE SAPPHIRE, and SINCERE No. 3 in the vicinity of 48°N, 160°E, all had waves over 30 ft.

The high winds and waves continued through the 12th in the area around 50°N, 165°E. The NEPTUNE SAPPHIRE had 49-kn winds and 43-ft waves, while the JAPAN ACE had 58-kn winds with 39-ft waves. Others were reporting waves over 30 ft. On the 13th the storm encompassed two more LOW centers across the Bering Sea. A frontal wave was traveling through the southern perimeter of the storm and became the primary center on the 14th.

The frontal wave with the previous storm dissipated near the Shumagin Islands, and this one formed in its wake. The storm was born with isolated gales and waves to 20 ft. On the 15th it was curving northward to make a cyclonic loop over the Gulf of Alaska. It

was of little concern until the 17th, when it started to consolidate the circulation. The fishing vessels BLUFIN and JUDI B. found winds up to 70 kn with 25- to 30-ft swells in the Gulf of Alaska. The MANHATTAN (51°N, 136°W) was in the southerly flow with 45-kn winds and 21-ft waves. These increased to 50 kn and 33 ft on the 18th. The G.B. REED at 52°N, 131°W, had 45 kn later in the day. At this time the NORTHWEST ENTERPRISE, POLAR STAR, and WENDY FOSS found winds of 40 to 55 kn gusting to 70 kn with waves to 14 ft in the vicinity of Kodiak Island and on Bristol Bay.

On the 19th this was a large 970-mb storm, but the winds reported were only minimal gales, except for 54 kn by the MAPLE ACE off the Queen Charlotte Islands. The storm rapidly dissipated on the 20th.

This storm came out of central Asia and deepened as it moved over Manchuria. On the 19th its eastern circulation reached the Sea of Japan. At 0000 on the 20th it was 984 mb over central Manchuria. The southerly winds were now east of Honshu. Ships north of Tokyo to Hokkaido were receiving winds up to 52 kn, which was reported by the OGDEN FRASER. The waves were less than 20 ft.

On the 21st a new center formed west of the Kurile Islands and frontal waves were moving over Japan. This broke up the circulation, and the winds decreased.

This LOW was a Japanese export. Twenty-four hours after it was first analyzed it was a small tight 989-mb storm at 0000 on the 18th. The CRYSTAL STAR was sailing east into 33-ft swell waves east of the center. The storm passed within 100 mi of the MENELAUS with 44-kn winds and 30-ft seas. On the 19th the BAHAMA MARU (37°N, 161°E) was contacted by 45-kn winds and 21-ft waves. Several ships had 45-kn winds on the 20th. On the 21st two Japanese ships had gales as the LOW passed between them. The KSBK was near Montague Island with southeasterly 60-kn winds and 33-ft waves. The storm was 964 mb near Kodiak Island. There were still gale reports on the 22d. Later in the day the storm deteriorated rapidly as it moved over land.

There were several weak LOWs and frontal waves east of Hokkaido on the 22d. This storm developed from one of these. Gales were occurring on the 23d. The KATORI MARU in the warm sector had 43-kn winds. The BUNGA MELAWIS (50°N, 175°W) had 50-kn winds from the north. On the 24th the SINALOA (48°N, 169°W) had 50-kn winds and 26-ft seas and a ship near 46°N, 159°W, had 33-ft waves. The ORIENTAL CHAMPION (47°N, 154°W) had only 40-kn winds and 13-ft seas, but the swells were 36 ft. The winds continued at about 40 kn, with several reports of waves over 30 ft along the coast. The ARCO ALASKA and HANJIN INCHEON on opposite sides of the storm at an average latitude of 51°N battled swell waves over 33 ft from the south and north, respectively. On the 26th the storm was falling apart.

This was a short-lived storm. It formed in a short-wave trough late on the 22d near 46°N, 150°W. At 1200 on the 23d it was 986 mb near 49°N, 142°W. There were only reports from buoys and OWS Papa at that time. At 1800 OWS Papa had 42-kn winds and 16-ft seas. Not far away (47°N, 141°W) a ship had 63-kn winds and 26-ft waves. The LOW above was moving into the area, and by the 25th it had completely absorbed this circulation.

Monster-of-the-Month--A long front stretched from a LOW near the Fox Islands to the Philippine Sea. On the 26th someone snapped the string, and a frontal wave formed near 37°N, 157°E. By the 27th there were gales and heavy rain with the storm. The DAISHIN MARU, west of the center, found 54-kn winds.

By 0000 on the 28th the storm was 972 mb at 43°N, 179°W. The PRESIDENT GRANT (42°N, 176°E) found northerly 55-kn winds with 41-ft swells. Two other ships reported winds over 50 kn. At 1200 a ship at 45°N, 180°, called the seas 41 ft. At 0000 on the 29th there were two observations of 78 kn with only one ship reporting waves, and these were very low for that windspeed. The pressure gradient would not appear to support this high wind, but both were positioned relative to the center where higher winds generally occur, and the pressures and direction fit the analysis. One was by the OGDEN FRASER at 48°N, 155°W, and the other by the PRESIDENT GRANT at 40°N, 175°W. There is a possibility that the wrong wind indicator was used, and the speed was doubled in converting to knots.

On the 30th the LOW was near Kodiak Island. The NORSE PILOT was 1,000 mi to the southwest with 30-ft swell waves. Another ship was 750 mi to the southeast with 23-ft swells. The storm stalled over the Gulf of Alaska on May 1 and disappeared on the 2d.

Tropical Cyclones, Western Pacific--Carmen, first tropical storm of the western North Pacific, meandered into the eastern waters to bring their first activity also. She actually began as an active cluster near 4°N, 178°W, on the 4th. Carmen drifted into western waters and began to organize by the 5th. By 1200 she was a tropical storm. Twenty-four hours later her winds peaked at 60 kn. At this time Carmen was near 17°N, 177.5°E, and recurving northeastward. She crossed into eastern waters on the 7th. The following day Carmen dissipated.

Casualties--On the 5th and 6th storms hit South Korea leaving at least nine people dead and over 300 homeless due to floods, landslides, and vessel damage. The IN WANG No. 2 (4,238 tons) dragged anchor and went aground. Fourteen other vessels grounded, capsized, or collided in Busan Harbor. The American tanker SPIRIT OF LIBERTY had heavy-weather damage repaired in San Francisco on the 9th. The 2,219-ton

Continued on page 383.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

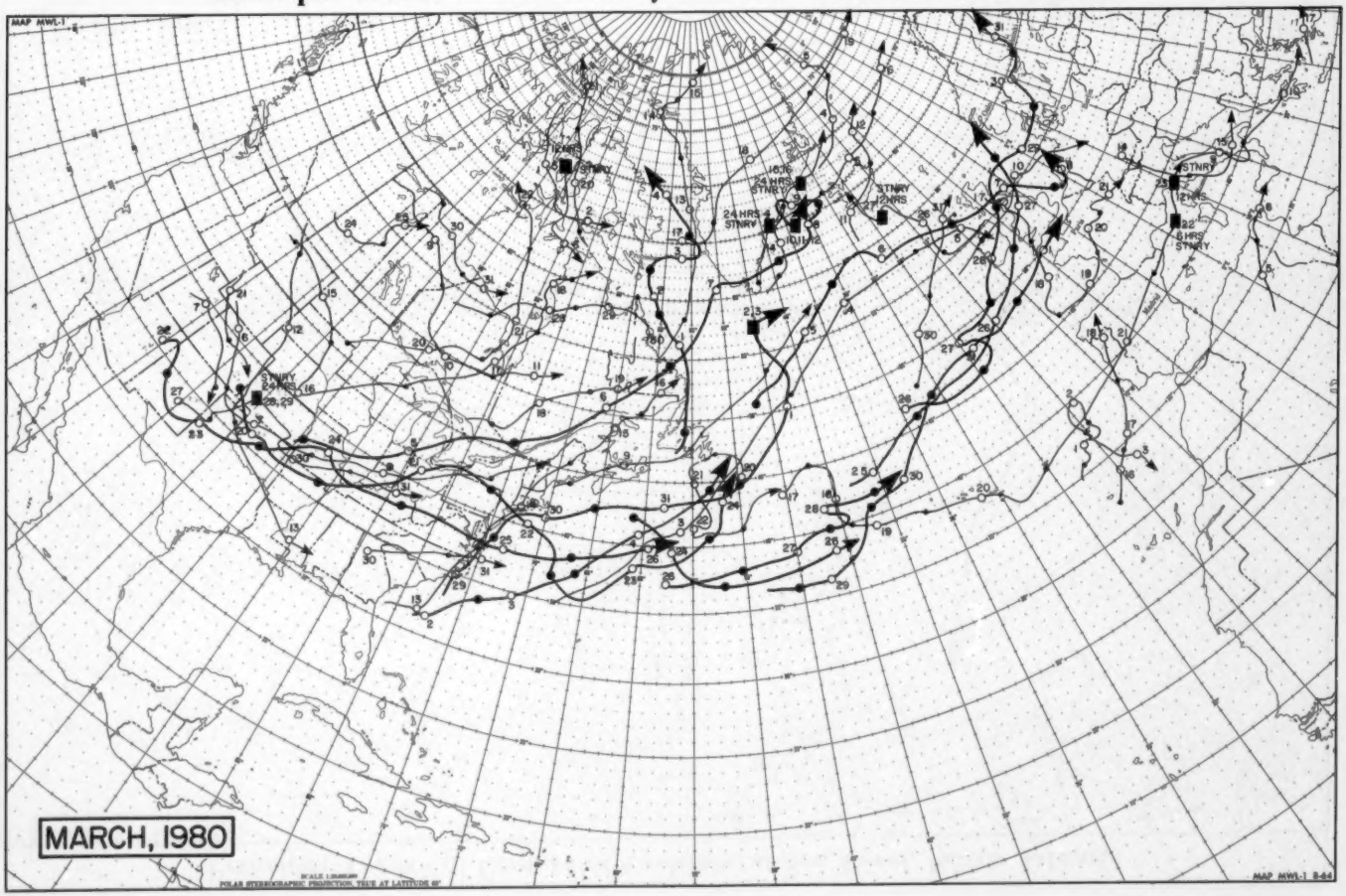


Figure 48. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

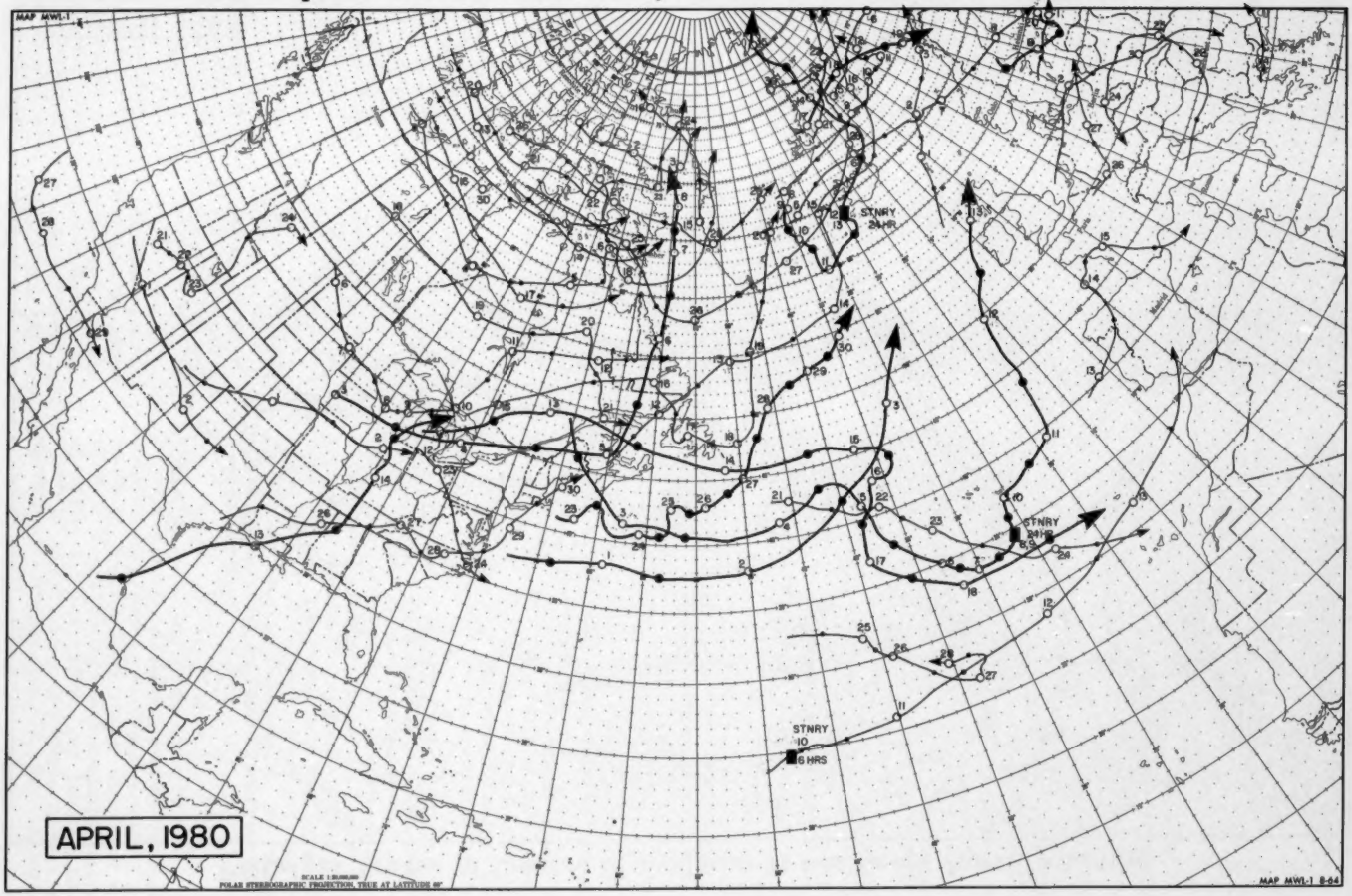


Figure 49. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

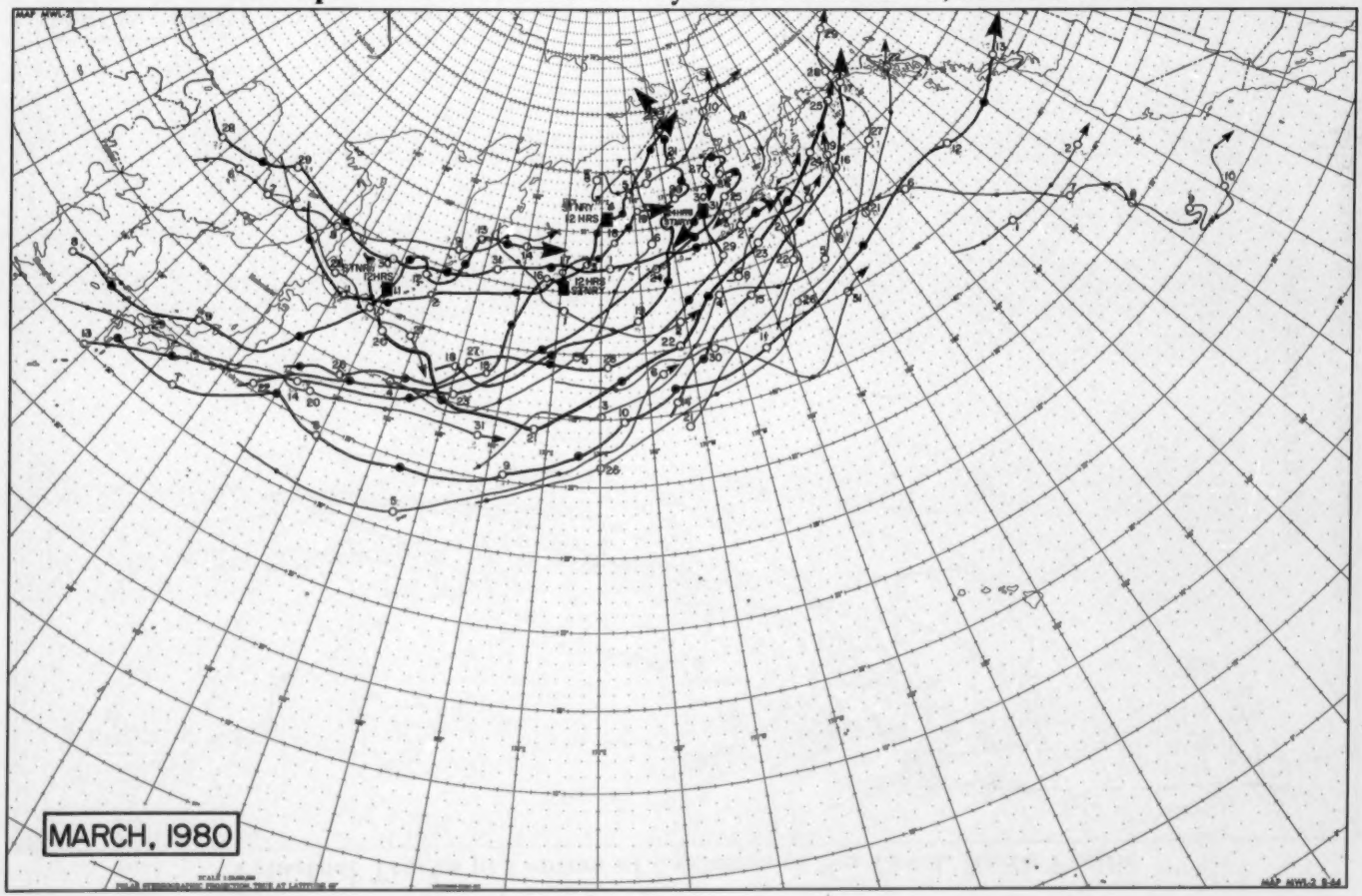


Figure 50.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

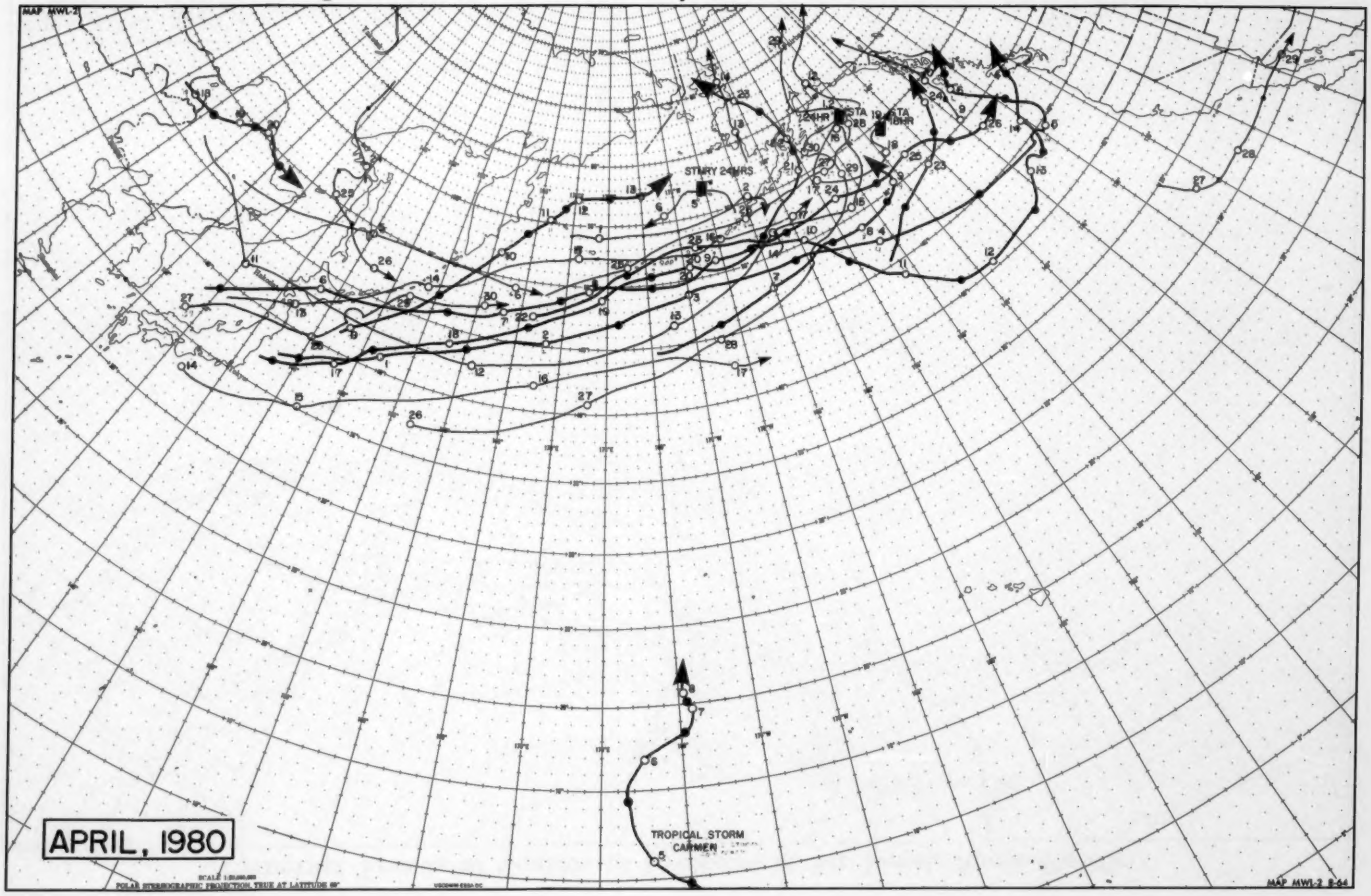
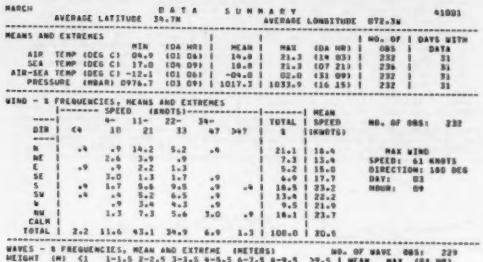


Figure 51.---Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

U.S. Ocean Buoy Climatological Data

March and April 1980



MARCH 41001

DATA SUMMARY

AVERAGE LATITUDE 34.7N AVERAGE LONGITUDE 072.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.9	(01 06)	14.8	21.3	(14 03)	232	31
SEA TEMP (DEG C)	17.0	(04 09)	18.8	21.3	(07 21)	236	31
AIR-SEA TEMP (DEG C)	-12.1	(01 06)	-00.8	02.0	(31 09)	232	31
PRESSURE (MBAR)	0976.7	(03 09)	1017.3	1033.9	(16 15)	232	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

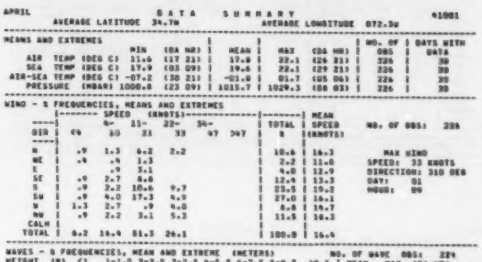
DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
	<0	10	21	33	47 >47	
N	.4	.9	14.2	5.2	.4	21.1	18.4
NE		2.6	3.9	.9		7.3	13.4
E	.9	.9	2.2	1.3		5.2	15.0
SE		3.0	1.3	1.7	.9	6.9	17.7
S	.9	1.7	9.6	9.5	.9 .4	16.5	23.2
SW	.4	.4	5.2	6.5	.9	13.4	22.2
W		.9	3.4	4.3	.9	9.5	21.9
NW		1.3	7.3	5.6	3.0 .9	18.1	23.7
CALM							
TOTAL	2.2	11.6	43.1	34.9	6.0 1.3	100.0	20.6

NO. OF OBS: 232

MAX WIND
SPEED: 61 KNOTS
DIRECTION: 180 DEG
DAY: 03
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 229

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		21.0	30.6	23.1	16.2	6.6	2.2	.4	3.1M	10.0M (03 15)



APRIL 41001

DATA SUMMARY

AVERAGE LATITUDE 34.7N AVERAGE LONGITUDE 072.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.6	(17 21)	17.8	22.1	(26 21)	226	30
SEA TEMP (DEG C)	17.9	(03 09)	19.6	22.1	(29 21)	226	30
AIR-SEA TEMP (DEG C)	-07.2	(30 21)	-01.8	01.7	(05 06)	226	30
PRESSURE (MBAR)	1000.8	(23 09)	1015.7	1029.3	(08 03)	226	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

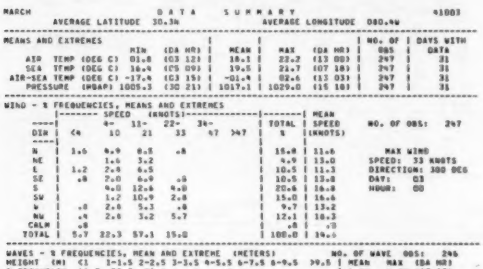
DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
	<0	10	21	33	47 >47	
N	.9	1.3	6.2	2.2		10.6	16.3
NE	.4	.4	1.3			2.2	11.6
E		.9	3.1			4.0	12.9
SE	.9	2.7	6.8			12.4	13.3
S	.9	2.2	10.6	9.7		23.5	19.2
SW	.9	4.0	17.3	4.9		27.0	16.1
W	1.3	2.7	.9	4.0		8.8	14.7
NW	.9	2.2	3.1	5.3		11.5	16.3
CALM							
TOTAL	4.2	16.4	51.3	26.1		100.0	16.4

NO. OF OBS: 226

MAX WIND
SPEED: 33 KNOTS
DIRECTION: 310 DEG
DAY: 01
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 224

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	6.3	40.6	32.6	14.7	5.8				2.0M	5.8M (01 12)



MARCH 41003

DATA SUMMARY

AVERAGE LATITUDE 30.3N AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.8	(03 12)	18.1	23.2	(13 00)	247	31
SEA TEMP (DEG C)	16.4	(05 09)	19.5	21.7	(07 18)	247	31
AIR-SEA TEMP (DEG C)	-17.6	(03 15)	-01.4	02.6	(13 03)	247	31
PRESSURE (MBAR)	1005.3	(30 21)	1017.1	1029.0	(15 18)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

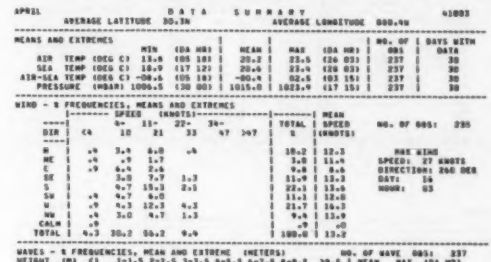
DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
	<0	10	21	33	47 >47	
N	1.6	4.9	8.5	.8		15.8	11.6
NE		1.6	3.2			4.9	13.0
E	1.2	2.8	6.5			10.5	11.3
SE	.8	7.0	10.5	.8		19.1	13.4
S		4.0	12.6	4.0		20.6	16.8
SW		1.2	10.9	2.8		15.0	16.6
W	.8	2.8	5.3	.8		9.7	13.2
NW	.4	2.8	3.2	5.7		12.1	18.3
CALM	.8					.8	.0
TOTAL	5.7	22.3	57.1	15.0		100.0	14.6

NO. OF OBS: 247

MAX WIND
SPEED: 33 KNOTS
DIRECTION: 300 DEG
DAY: 03
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 245

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	10.3	55.3	25.6	.4	.4				1.4M	4.0M (03 03)



APRIL 41003

DATA SUMMARY

AVERAGE LATITUDE 30.3N AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.6	(05 18)	20.2	23.5	(26 03)	237	30
SEA TEMP (DEG C)	18.7	(17 12)	20.6	23.4	(28 03)	237	30
AIR-SEA TEMP (DEG C)	-06.6	(05 18)	-00.4	02.5	(03 15)	237	30
PRESSURE (MBAR)	1006.5	(30 00)	1015.8	1023.9	(17 15)	237	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

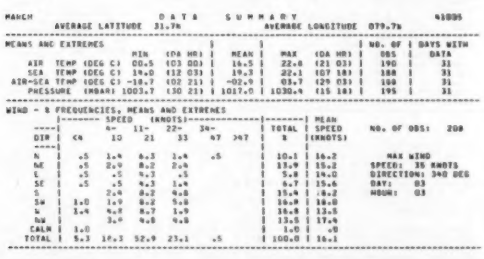
DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
	<0	10	21	33	47 >47	
N	.9	3.4	6.8	.4		10.2	12.3
NE	.4	.9	1.7			3.0	11.4
E	.9	4.4	2.6			7.8	8.6
SE		3.8	7.7	1.3		12.9	13.2
S		4.7	15.2	2.1		22.1	13.6
SW	.4	4.7	6.8			11.1	12.8
W	.9	4.3	12.2	4.3		21.7	16.3
NW	.4	3.0	4.7	1.3		9.4	13.9
CALM	.9					.9	.0
TOTAL	4.3	30.2	58.2	9.4		100.0	13.2

NO. OF OBS: 235

MAX WIND
SPEED: 27 KNOTS
DIRECTION: 260 DEG
DAY: 14
HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 237

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	19.0	65.4	15.6						1.2M	2.5M (21 15)



MARCH 41035

DATA SUMMARY

AVERAGE LATITUDE 31.7N AVERAGE LONGITUDE 079.7W

MEANS AND EXTREMES

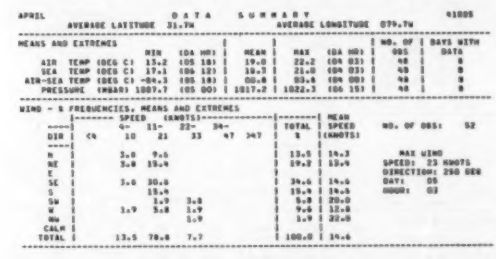
	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	00.5	(03 00)	16.5	22.6	(21 03)	190	31
SEA TEMP (DEG C)	19.0	(12 03)	19.3	22.1	(07 18)	188	31
AIR-SEA TEMP (DEG C)	-10.7	(02 21)	-02.9	03.7	(29 03)	188	31
PRESSURE (MBAR)	1003.7	(30 21)	1017.0	1030.4	(15 18)	195	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
	<0	10	21	33	47 >47	
N	.5	1.4	6.3	1.4	.5	10.1	16.2
NE	.5	2.9	8.2	2.4		13.9	15.2
E	.5	.5	4.3	.5		5.8	14.0
SE	.5	.5	4.3	1.4		6.7	15.6
S		2.4	8.2	4.8		15.4	18.2
SW	1.0	1.9	9.2	5.8		17.8	18.0
W	1.4	4.8	8.7	1.9		16.8	13.5
NW		3.4	4.8	4.8		13.5	17.4
CALM	1.0					1.0	.0
TOTAL	5.3	18.1	52.9	23.1	.5	100.0	16.1

NO. OF OBS: 208

MAX WIND
SPEED: 35 KNOTS
DIRECTION: 340 DEG
DAY: 03
HOUR: 03



APRIL 41035

DATA SUMMARY

AVERAGE LATITUDE 31.7N AVERAGE LONGITUDE 079.7W

MEANS AND EXTREMES

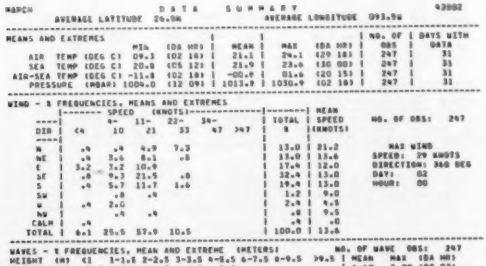
	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.2	(05 18)	19.0	22.2	(04 03)	48	8
SEA TEMP (DEG C)	17.1	(06 12)	19.3	21.0	(04 03)	48	8
AIR-SEA TEMP (DEG C)	-04.3	(05 18)	-00.8	03.8	(04 00)	48	8
PRESSURE (MBAR)	1007.7	(05 00)	1017.2	1022.3	(00 15)	48	8

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
	<0	10	21	33	47 >47	
N		3.8	9.6			13.5	14.3
NE		5.8	13.4			19.2	13.4
E							
SE		3.8	30.8			34.6	14.6
S			15.4			15.4	14.6
SW			3.8	3.8		7.7	20.0
W		1.9	5.8	1.9		9.6	12.8
NW				1.9		1.9	22.0
CALM							
TOTAL		13.5	78.8	7.7		100.0	14.4

NO. OF OBS: 52

MAX WIND
SPEED: 23 KNOTS
DIRECTION: 260 DEG
DAY: 05
HOUR: 03



MARCH 42002

DATA SUMMARY

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.1	(02 18)	21.1	24.1	(29 18)	247	31
SEA TEMP (DEG C)	20.6	(05 12)	23.9	25.6	(30 00)	247	31
AIR-SEA TEMP (DEG C)	-11.8	(02 18)	-00.9	01.6	(20 15)	247	31
PRESSURE (MBAR)	1004.0	(12 09)	1013.9	1030.9	(02 18)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

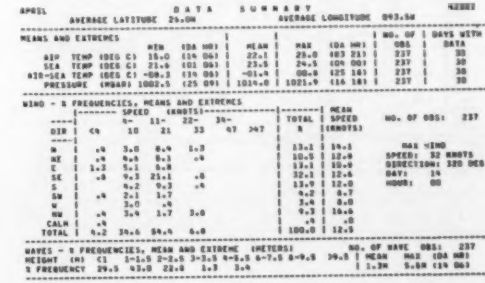
DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
	<0	10	21	33	47 >47	
N	.4	.4	4.9	7.3		13.0	21.2
NE	.4	3.6	8.1	.8		13.0	13.6
E	3.2	3.2	10.9			17.4	12.0
SE	.8	7.3	21.5	.8		32.4	13.0
S	.4	5.7	11.7	1.6		19.4	13.0
SW		.8	.4			1.2	9.0
W	.4	2.0				2.4	4.5
NW		.4	.4			.8	9.5
CALM	.4					.4	.0
TOTAL	4.1	23.5	57.9	10.5		100.0	13.6

NO. OF OBS: 247

MAX WIND
SPEED: 29 KNOTS
DIRECTION: 340 DEG
DAY: 02
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	5.3	63.2	24.7	4.0	2.8				1.6M	5.0M (02 03)



APRIL 42002

DATA SUMMARY

AVERAGE LATITUDE 25.0N AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	15.0	(26 06)	22.1	25.8	(03 21)	237	30
SEA TEMP (DEG C)	21.6	(01 06)	23.5	24.5	(04 00)	237	30
AIR-SEA TEMP (DEG C)	-08.3	(19 06)	-01.4	00.4	(25 18)	237	30
PRESSURE (MBAR)	1002.6	(25 09)	1014.0	1025.9	(16 18)	237	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
	<0	10	21	33	47 >47	
N		3.8	6.4	1.3		13.1	14.1
NE		.4	4.6	.4		10.5	12.4
E	1.3	5.1	10.5			16.9	10.8
SE	.8	9.3	21.1	.8		32.1	12.6
S		4.2	9.3	.4		13.9	12.0
SW	.4	2.1	1.7			4.2	8.7
W		3.0	.4			3.4	8.0
NW	.4	3.4	1.7	3.0		9.3	14.6
CALM	.4					.4	.0
TOTAL	3.2	34.6	56.4	6.0		100.0	12.5

NO. OF OBS: 237

MAX WIND
SPEED: 32 KNOTS
DIRECTION: 320 DEG
DAY: 14
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 237

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	29.5	43.0	22.8	1.3	3.4				1.3M	5.8M (19 06)

MARCH 42003

DATA SUMMARY

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.8	(03 03)	23.1	28.5	(30 03)	247	31
SEA TEMP (DEG C)	25.2	(07 03)	25.9	26.7	(29 21)	247	31
AIR-SEA TEMP (DEG C)	-13.8	(03 03)	-02.8	00.2	(30 15)	247	31
PRESSURE (MBAR)	1009.8	(30 09)	1016.7	1028.0	(03 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	NO. OF OBS: 247
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	(KNOTS)	
N			6.9	1.6			8.5	17.2	MAX WIND
NE		2.0	5.7	.4			8.1	14.2	SPEED: 30 KNOTS
E		2.4	6.9	.4			9.7	15.3	DIRECTION: 320 DEG
SE		2.8	27.1	1.2			31.2	15.4	DAY: 02
S	.4	7.7	17.4	2.8			27.5	13.6	HOUR: 19
SW		2.0	4.0	.4			6.5	13.7	
W		1.2	1.2				2.4	9.9	
NW		2.4	1.6	2.0			6.1	17.1	
CALM									
TOTAL	.4	20.6	70.9	8.1			100.0	14.8	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 249

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	4.8	63.5	28.7	2.5	.8				1.5M	5.0M (02 18)

APRIL 42003

DATA SUMMARY

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	18.8	(15 06)	23.7	28.8	(19 00)	237	30
SEA TEMP (DEG C)	25.6	(22 18)	27.3	29.1	(30 21)	237	30
AIR-SEA TEMP (DEG C)	-07.4	(15 06)	-02.4	00.4	(19 00)	237	30
PRESSURE (MBAR)	1009.8	(13 21)	1015.7	1023.6	(16 15)	237	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	NO. OF OBS: 237
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	(KNOTS)	
N		3.0	10.5				13.5	11.7	MAX WIND
NE	.4	5.5	3.8				9.7	9.9	SPEED: 28 KNOTS
E		6.9	8.3	.4			15.7	11.2	DIRECTION: 280 DEG
SE		3.0	11.8	1.7			16.5	13.2	DAY: 14
S	.8	6.8	6.4	1.3			17.3	12.3	HOUR: 00
SW	2.1	3.0	.8	.4			6.3	8.7	
W	1.3	3.0	1.7				5.9	7.7	
NW		2.5	14.3	.8			17.7	14.1	
CALM	.4						.4	.0	
TOTAL	5.1	32.5	57.8	4.6			100.0	12.0	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 237

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	23.2	64.6	8.4	3.4	.4				1.2M	4.0M (14 18)

MARCH 42005

DATA SUMMARY

AVERAGE LATITUDE 30.0N AVERAGE LONGITUDE 085.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	13.6	(02 15)	18.6	21.1	(30 06)	247	31
SEA TEMP (DEG C)	23.7	(03 15)	24.5	25.5	(31 21)	247	31
AIR-SEA TEMP (DEG C)	-17.6	(02 15)	-01.0	03.4	(05 21)	247	31
PRESSURE (MBAR)	1008.6	(30 09)	1016.6	1030.1	(03*15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	NO. OF OBS: 247
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	(KNOTS)	
N		.8	10.1	1.6			12.6	16.0	MAX WIND
NE	.4	2.0	2.4	.4			5.3	12.8	SPEED: 31 KNOTS
E		5.3	12.1	1.2			18.6	14.6	DIRECTION: 330 DEG
SE		4.0	11.3	3.2			18.6	15.3	DAY: 02
S	.4	4.5	9.3	1.2			15.4	14.3	HOUR: 15
SW		4.0	4.9	.8			9.7	13.3	
W		4.5	5.7				10.1	12.4	
NW		1.6	2.4	5.7			9.7	21.3	
CALM									
TOTAL	.8	26.7	58.3	14.2			100.0	15.1	

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: .4% SEVERE: NONE #OBS: 247

APRIL 42005

DATA SUMMARY

AVERAGE LATITUDE 30.0N AVERAGE LONGITUDE 085.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.6	(14 18)	18.6	22.3	(25 21)	239	30
SEA TEMP (DEG C)	17.9	(14 12)	19.8	21.8	(25 21)	239	30
AIR-SEA TEMP (DEG C)	-08.9	(14 18)	-00.2	02.4	(21 21)	239	30
PRESSURE (MBAR)	1003.2	(13 21)	1014.6	1024.0	(17 15)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	NO. OF OBS: 239
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	(KNOTS)	
N	.8	4.6	4.2	1.7			11.3	12.8	MAX WIND
NE		3.8	6.0				9.8	11.1	SPEED: 31 KNOTS
E		4.2	9.0				9.2	11.8	DIRECTION: 240 DEG
SE		4.6	11.7	.8			17.2	13.2	DAY: 14
S		3.8	3.3	.8			7.9	11.9	HOUR: 15
SW	1.3	6.3	7.1	.4			15.1	11.7	
W	.8	9.6	12.6	4.6			22.6	15.8	
NW		3.3	2.1	2.1			7.9	14.1	
CALM									
TOTAL	3.3	35.1	51.8	10.5			100.0	13.2	

MARCH 44002

DATA SUMMARY

AVERAGE LATITUDE 40.1N AVERAGE LONGITUDE 073.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-10.0	(01 09)	03.9	10.3	(22 00)	244	31
SEA TEMP (DEG C)	03.1	(15 06)	05.0	06.1	(16 21)	244	31
AIR-SEA TEMP (DEG C)	-14.5	(01 09)	-01.2	04.6	(22 00)	244	31
PRESSURE (MBAR)	0987.1	(22 06)	1015.5	1033.3	(16 15)	244	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	NO. OF OBS: 244
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	(KNOTS)	
N	.8	2.9	11.1	1.2			16.0	14.3	MAX WIND
NE	.4	1.2	3.7	3.3			8.6	18.4	SPEED: 31 KNOTS
E		1.2	4.1	3.7			9.0	19.5	DIRECTION: 100 DEG
SE	.4	2.0	2.0	1.2			5.7	13.6	DAY: 16
S		4.5	4.5	.8			13.9	12.7	HOUR: 00
SW	.4	3.3	12.3	.4			16.4	13.8	
W	.4	2.5	2.9	1.6			7.4	13.3	
NW		2.9	13.1	7.0			23.0	17.9	
CALM									
TOTAL	2.5	22.5	56.7	19.3			100.0	15.5	

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: 7.4% SEVERE: NONE #OBS: 244

APRIL 44002

DATA SUMMARY

AVERAGE LATITUDE 40.1N AVERAGE LONGITUDE 073.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.8	(17 09)	07.6	11.5	(21 21)	238	30
SEA TEMP (DEG C)	04.2	(03 12)	06.4	08.9	(24 18)	238	30
AIR-SEA TEMP (DEG C)	-03.9	(17 09)	-01.2	04.8	(15 09)	238	30
PRESSURE (MBAR)	0998.1	(05 00)	1013.7	1030.6	(07 18)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	NO. OF OBS: 238
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	(KNOTS)	
N	.8	2.5	3.4	.8			7.6	12.8	MAX WIND
NE		2.9	2.1	.8			5.9	13.5	SPEED: 30 KNOTS
E	.8	5.9	7.6	2.1			16.8	13.8	DIRECTION: 080 DEG
SE	1.7	4.6	6.7				13.0	10.2	DAY: 01
S	.8	4.3	5.0				12.2	10.2	HOUR: 08
SW	1.3	10.9	7.6				19.7	9.8	
W	2.1	10.5	2.9				15.5	7.5	
NW		5.0	3.8	.8			9.7	11.9	
CALM	.4						.4	.0	
TOTAL	8.0	48.3	39.1	4.6			100.0	10.7	

MARCH 44003

DATA SUMMARY

AVERAGE LATITUDE 40.8N AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-08.1	(01 12)	03.1	09.2	(14 12)	247	31
SEA TEMP (DEG C)	02.9	(04 12)	04.7	06.7	(30 18)	247	31
AIR-SEA TEMP (DEG C)	-11.1	(01 12)	-00.5	05.8	(14 12)	247	31
PRESSURE (MBAR)	0990.2	(22 12)	1014.9	1030.8	(17 03)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	NO. OF OBS: 194
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	(KNOTS)	
N		3.1	11.3	6.2			20.6	17.4	MAX WIND
NE		1.0	4.6	5.7			11.3	21.0	SPEED: 35 KNOTS
E		3.1	3.1	1.5	1.5		9.3	18.9	DIRECTION: 080 DEG
SE		3.6	3.6	.5			7.2	12.9	DAY: 22
S		10.3	8.2	.5			19.1	11.1	HOUR: 15
SW	.5	2.6	3.1	.5			6.7	11.2	
W	.5	3.6	4.1	5.2			13.4	16.2	
NW	.5		9.3	2.6			12.4	18.5	
CALM									
TOTAL	1.5	27.3	46.9	22.7	1.5		100.0	16.0	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 246

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	2.8	10.7	30.5	23.6	21.5	4.5	.4		3.1M	8.5M (22 15)

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: 4.6% SEVERE: NONE #OBS: 194

APRIL 44003

DATA SUMMARY

AVERAGE LATITUDE 40.8N AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	03.8	(02 06)	08.3	11.3	(15 15)	237	30
SEA TEMP (DEG C)	04.4	(01 00)	05.4	06.3	(30 21)	237	30
AIR-SEA TEMP (DEG C)	-02.6	(17 18)	00.9	06.6	(15 15)	237	30
PRESSURE (MBAR)	0991.3	(22 12)	1015.1	1034.1	(07 15)	237	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)					TOTAL	MEAN SPEED	NO. OF OBS: 237
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	(KNOTS)	
N	2.5	2.1	2.1	1.3			8.0	10.7	MAX WIND
NE		3.4	2.5	1.3			7.2	13.7	SPEED: 28 KNOTS
E	.8	7.2	13.4	.4			19.8	11.6	DIRECTION: 320 DEG
SE	1.3	1.3	6.3				8.9	11.8	DAY: 23
S	.8	7.2	6.8	.4			15.2	10.4	HOUR: 03
SW	1.3	5.7	6.3				13.3	9.8	
W	.8	5.9	7.2	.4			14.3	10.9	
NW	1.3	3.4	3.8	.8			9.3	11.3	
CALM									
TOTAL	8.9	40.1	46.4	4.6			100.0	10.9	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 237

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	5.5	47.7	24.1	19.9	3.4				1.9M	4.5M (05 12)

MARCH — DATA SUMMARY — 44004

AVERAGE LATITUDE 39.0N — AVERAGE LONGITUDE 070.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-04.9	(01 06)	07.9	18.1	(14 09)	247	31
SEA TEMP (DEG C)	08.8	(29 15)	13.4	19.8	(18 21)	247	31
AIR-SEA TEMP (DEG C)	-17.5	(01 09)	-05.5	01.8	(25 03)	247	31
PRESSURE (MBAR)	0987.0	(22 18)	1016.7	1033.6	(17 06)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.4	7.3	8.5	4.0		20.2	25.2
NE		1.2	2.8	1.6	.8		5.7	21.9
E	.4	1.2	1.2	1.2	.8		4.9	18.1
SE		.8	4.0	2.4	.4		7.7	20.0
S	.4	3.6	4.9	4.9	.4		14.2	18.6
SW		.4	2.0	5.3			7.7	21.9
W	.4	2.0	2.8	5.7	4.9		15.8	25.3
NW		2.0	7.7	8.5	1.6		19.8	21.7
CALM								
TOTAL	1.2	11.7	34.0	40.1	13.0		100.0	22.1

NO. OF OBS: 247

MAX WIND SPEED: 44 KNOTS DIRECTION: 030 DEG DAY: 23 HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 246

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	3.7	16.7	25.2	25.2	18.3	10.6	.4		3.2M	8.0M (23 00)

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: 2.4% SEVERE: NONE BOBS: 247

APRIL — DATA SUMMARY — 44004

AVERAGE LATITUDE 39.0N — AVERAGE LONGITUDE 070.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.6	(17 15)	11.5	17.8	(28 15)	238	30
SEA TEMP (DEG C)	09.7	(07 15)	13.5	19.5	(30 18)	238	30
AIR-SEA TEMP (DEG C)	-08.3	(17 15)	-02.0	04.3	(05 00)	238	30
PRESSURE (MBAR)	0996.5	(23 18)	1016.2	1033.0	(04 12)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			3.8	3.4	2.9	.4	10.5	19.6
NE		.8	1.7	.8	1.3	.4	5.0	19.8
E		.4	5.0	9.2			14.7	13.2
SE		1.7	2.5	10.1	1.7		16.0	13.6
S		.4	5.0	7.6	1.3		14.3	13.2
SW		.4	3.4	4.2			8.0	11.1
W		.8	5.0	7.1	2.9		15.8	14.0
NW		.8	4.6	5.0	4.2	.4	15.1	15.1
CALM		.4					.4	.0
TOTAL	1.9	31.1	47.5	44.3	14.3	.4	100.0	13.9

NO. OF OBS: 238

MAX WIND SPEED: 41 KNOTS DIRECTION: 030 DEG DAY: 01 HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 238

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	8.0	48.7	21.4	18.7	7.1				1.9M	5.5M (01 15)

MARCH — DATA SUMMARY — 44005

AVERAGE LATITUDE 42.7N — AVERAGE LONGITUDE 060.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-09.5	(01 09)	02.5	08.2	(18 15)	246	31
SEA TEMP (DEG C)	04.3	(07 06)	08.1	08.9	(28 18)	246	31
AIR-SEA TEMP (DEG C)	-19.5	(01 12)	-02.6	03.1	(06 03)	246	31
PRESSURE (MBAR)	0989.8	(11 18)	1014.4	1030.4	(13 15)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			2.0	8.9	7.3	.4	18.3	19.4
NE			1.6	6.1	4.1	.4	12.2	19.1
E			.4	1.2	.8	2.0	4.5	23.8
SE			1.6	3.3	2.8	.4	7.3	16.9
S			3.7	5.3	2.0	.4	11.4	16.2
SW			1.6	10.2	1.6		13.4	15.4
W			1.6	5.3	4.5	5.7	17.5	24.4
NW		.4	.8	3.3	8.5	2.0	15.0	23.6
CALM								
TOTAL		.4	13.0	46.3	28.9	11.4	100.0	20.1

MAX WIND SPEED: 48 KNOTS DIRECTION: 090 DEG DAY: 22 HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 149

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	5.4	24.2	34.9	16.8	10.1	.7			2.6M	6.5M (22 12)

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: 15.4% SEVERE: NONE BOBS: 246

APRIL — DATA SUMMARY — 44005

AVERAGE LATITUDE 42.7N — AVERAGE LONGITUDE 060.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.2	(17 15)	06.1	11.0	(15 16)	237	30
SEA TEMP (DEG C)	08.3	(01 06)	08.4	08.7	(27 18)	237	30
AIR-SEA TEMP (DEG C)	-05.8	(17 15)	-00.3	04.7	(15 18)	237	30
PRESSURE (MBAR)	0989.6	(23 09)	1014.6	1036.1	(07 18)	237	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.8	4.6	3.8	3.4		13.1	18.1
NE			2.1	3.4			5.5	15.7
E		.4	1.3	5.5	4.6		11.8	18.1
SE			.8	10.1	1.3		12.2	16.6
S		.4	3.8	6.8	3.4		14.3	15.3
SW		.8	5.5	6.4	.8		13.6	13.1
W		.4	6.3	8.8	.4		15.9	16.7
NW		.4	7.6	4.6	.8		13.5	11.5
CALM								
TOTAL		3.0	32.1	49.5	14.5		100.0	16.2

NO. OF OBS: 237

MAX WIND SPEED: 32 KNOTS DIRECTION: 010 DEG DAY: 23 HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 197

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	8.3	48.4	33.1	7.0	3.2				1.7M	5.5M (23 12)

MARCH — DATA SUMMARY — 44001

AVERAGE LATITUDE 56.0N — AVERAGE LONGITUDE 140.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-01.8	(19 18)	02.6	06.9	(26 21)	247	31
SEA TEMP (DEG C)	03.7	(15 15)	04.1	04.5	(25 03)	247	31
AIR-SEA TEMP (DEG C)	-05.6	(12 15)	-01.5	00.5	(30 12)	247	31
PRESSURE (MBAR)	0984.2	(16 09)	1005.2	1021.7	(27 18)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			2.0	.8	.8		3.6	13.5
NE				.4	1.2		1.6	23.5
E		.8	1.6	3.6	3.2	.4	9.3	18.1
SE			.8	12.7	9.1	.8	23.5	19.0
S		.8	4.5	10.5	5.3		21.1	16.1
SW		.8	2.0	4.9	9.1		16.2	19.0
W		.8	2.4	13.4	7.7	.4	24.3	18.7
NW		.8	2.4	3.2	5.3		11.7	17.8
CALM		.4					.4	.0
TOTAL		3.6	16.2	48.9	37.7	1.6	100.0	18.3

NO. OF OBS: 247

MAX WIND SPEED: 41 KNOTS DIRECTION: 130 DEG DAY: 30 HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 246

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	.4	10.6	27.6	33.3	24.8	3.3			3.2M	7.5M (26 18)

APRIL — DATA SUMMARY — 44001

AVERAGE LATITUDE 56.0N — AVERAGE LONGITUDE 140.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.7	(21 03)	03.6	05.2	(28 03)	236	30
SEA TEMP (DEG C)	04.1	(09 18)	04.7	05.8	(29 00)	236	30
AIR-SEA TEMP (DEG C)	-02.0	(21 03)	-01.1	00.6	(01 06)	236	30
PRESSURE (MBAR)	0969.6	(19 15)	0995.0	1012.3	(01 00)	236	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.4	1.7	4.2	.4		6.8	12.6
NE		.4	.8	4.7	2.5		8.5	16.9
E			5.4	10.2	7.6		23.2	16.2
SE			2.5	9.7	9.7	.8	22.7	18.9
S		2.1	3.0	8.9	5.0		19.1	16.7
SW		1.7	3.0	3.4	1.3		9.3	11.9
W		.4	3.8	4.7	1.3		10.2	13.4
NW			.4	3.0			3.4	15.5
CALM		1.7					1.7	.0
TOTAL		6.8	21.6	47.0	23.7	.8	100.0	15.3

NO. OF OBS: 236

MAX WIND SPEED: 42 KNOTS DIRECTION: 140 DEG DAY: 05 HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 235

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		9.1	43.1	38.2	9.4	1.7			2.0M	7.0M (01 12)

MARCH — DATA SUMMARY — 44002

AVERAGE LATITUDE 42.5N — AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.5	(14 09)	09.4	11.6	(01 00)	247	31
SEA TEMP (DEG C)	11.2	(23 15)	12.0	13.2	(10 00)	247	31
AIR-SEA TEMP (DEG C)	-06.7	(14 09)	-02.6	00.0	(28 15)	247	31
PRESSURE (MBAR)	1001.5	(04 18)	1021.4	1034.7	(23 18)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			5.7	14.2	2.0		21.9	14.2
NE			2.4	2.0			4.5	10.2
E			.4				.4	6.0
SE			1.2	.4	.8		2.4	13.5
S		1.2	1.6	1.2			4.0	8.1
SW			2.4	8.1	2.0	.8	13.3	15.8
W			8.5	13.8	4.9		27.1	15.4
NW		.4	4.5	15.0	8.1	.4	28.3	17.1
CALM								
TOTAL		1.6	28.7	52.6	17.8	1.2	100.0	15.1

NO. OF OBS: 247

MAX WIND SPEED: 35 KNOTS DIRECTION: 230 DEG DAY: 21 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		6.9	29.6	44.9	14.2	4.5			3.1M	7.0M (20 21)

APRIL — DATA SUMMARY — 44002

AVERAGE LATITUDE 42.5N — AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.0	(04 03)	10.1	11.8	(19 00)	239	30
SEA TEMP (DEG C)	10.6	(19 18)	11.4	12.5	(30 21)	239	30
AIR-SEA TEMP (DEG C)	-04.3	(06 03)	-01.4	00.5	(18 18)	239	30
PRESSURE (MBAR)	0998.9	(06 12)	1017.5	1031.7	(01 06)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			4.2	9.2	1.3		14.6	13.3
NE			.8				.8	6.5
E			.4				.4	5.0
SE			2.1	4.2			6.3	12.5
S			15.0	14.2	3.3		34.7	14.4
SW		.4	5.0	5.9	2.1		13.4	13.3
W		.4	7.9	11.7	4.6		24.7	14.8
NW		.4	1.3	8.4			10.0	14.4
CALM								
TOTAL		1.3	31.8	55.0	11.3		100.0	14.0

NO. OF OBS: 239

MAX WIND SPEED: 32 KNOTS DIRECTION: 240 DEG DAY: 12 HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		9.6	29.7	38.5	20.4	3.8			3.3M	7.5M (05 00)

MARCH — DATA SUMMARY — 46004

AVERAGE LATITUDE 51.0N — AVERAGE LONGITUDE 136.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	OBS	DAYS WITH DATA
AIR TEMP (DEG C)	00.0	(14 00)	05.2	07.2	(01 09)	247	31
SEA TEMP (DEG C)	05.5	(15 18)	05.8	06.4	(24 00)	247	31
AIR-SEA TEMP (DEG C)	-05.8	(14 00)	-00.6	01.4	(01 09)	247	31
PRESSURE (MBAR)	0998.8	(17 03)	1018.3	1038.6	(31 21)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS)						TOTAL	MEAN SPEED (KNOTS)	NO. OF OBS: 247
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	
N		.4	1.6	4.0			6.1	11.6
NE			1.2	1.6			2.8	10.7
E			.8				1.2	11.7
SE		.4	1.6	3.2			5.3	11.5
S			3.6	7.7	7.3		18.6	18.8
SW			1.6	12.1	4.9		18.6	17.7
W			1.6	13.8	12.1		27.8	20.2
NW		1.2	2.4	8.9	6.9	.4	19.8	18.2
CALM								
TOTAL		2.0	14.6	51.8	31.2	.4	100.0	17.7

MAX WIND: SPEED: 39 KNOTS; DIRECTION: 310 DEG; DAY: 17; HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 189

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		11.6	49.2	29.1	9.5	.5			2.7M	6.0M (17 18)

APRIL — DATA SUMMARY — 46004

AVERAGE LATITUDE 51.0N — AVERAGE LONGITUDE 136.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.0	(06 15)	06.2	08.4	(01 09)	239	30
SEA TEMP (DEG C)	05.8	(09 15)	06.1	06.9	(01 00)	239	30
AIR-SEA TEMP (DEG C)	-01.9	(18 18)	00.1	01.8	(11 21)	239	30
PRESSURE (MBAR)	0979.1	(04 06)	1005.5	1038.8	(01 00)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS)						TOTAL	MEAN SPEED (KNOTS)	NO. OF OBS: 239
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	
N		.4	.8	3.8	.8		5.9	14.5
NE			.4	.4			.8	8.0
E		.8	.8	2.9	1.3		5.4	15.9
SE			.8	10.8	4.6	.4	15.9	20.3
S			2.9	17.2	21.8	2.1	43.9	22.4
SW			2.1	9.2	3.3		14.6	18.2
W			1.7	4.3	1.7	1.3	10.9	19.9
NW			.4	1.7	.8		2.5	19.2
CALM								
TOTAL		.8	10.0	51.5	33.9	3.8	100.0	20.2

MAX WIND: SPEED: 43 KNOTS; DIRECTION: 280 DEG; DAY: 06; HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 210

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY			6.0	18.8	51.8	22.4			3.2M	5.5M (24 03)

MARCH — DATA SUMMARY — 46005

AVERAGE LATITUDE 46.0N — AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	OBS	DAYS WITH DATA
AIR TEMP (DEG C)	03.4	(14 15)	07.6	09.7	(28 06)	247	31
SEA TEMP (DEG C)	08.3	(26 15)	08.8	09.2	(10 03)	247	31
AIR-SEA TEMP (DEG C)	-05.3	(14 15)	-01.1	01.1	(29 06)	247	31
PRESSURE (MBAR)	0994.8	(12 21)	1016.2	1033.6	(23 06)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS)						TOTAL	MEAN SPEED (KNOTS)	NO. OF OBS: 247
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	
N			4.0	8.5	1.6		14.2	13.8
NE			4.0	1.2	1.6		6.9	12.5
E			1.2	1.6	1.2		4.0	15.3
SE			.4	.8			1.2	10.7
S			1.2	6.1	1.6	.8	9.6	17.9
SW			.8	9.3	2.8		12.1	17.7
W			2.4	16.8	7.7	2.4	28.3	19.9
NW			2.0	9.3	11.7	.8	23.9	21.0
CALM								
TOTAL			16.2	52.6	27.5	3.6	100.0	16.8

MAX WIND: SPEED: 43 KNOTS; DIRECTION: 270 DEG; DAY: 13; HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		7.7	38.5	38.1	12.6	3.2			3.0M	7.0M (13 03)

APRIL — DATA SUMMARY — 46005

AVERAGE LATITUDE 46.0N — AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.5	(06 15)	08.4	10.0	(18 15)	239	30
SEA TEMP (DEG C)	08.2	(21 15)	08.6	09.4	(30 21)	239	30
AIR-SEA TEMP (DEG C)	-02.9	(06 15)	-00.2	01.8	(18 15)	239	30
PRESSURE (MBAR)	0989.8	(05 12)	1013.5	1032.5	(01 03)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS)						TOTAL	MEAN SPEED (KNOTS)	NO. OF OBS: 239
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	
N			.4	3.3	.4		4.2	15.8
NE			.4				.8	6.0
E			.8	2.5	.4		3.8	15.4
SE			2.5	10.0	5.0	.8	18.4	18.8
S			4.2	22.6	4.6		31.4	18.5
SW			3.8	10.0	3.3	2.5	19.7	18.4
W			2.9	7.9	7.5		18.4	19.1
NW				3.8			3.8	15.3
CALM								
TOTAL			15.1	60.3	21.3	3.3	100.0	17.7

MAX WIND: SPEED: 42 KNOTS; DIRECTION: 120 DEG; DAY: 07; HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 236

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY			3.8	43.7	30.7	19.7	2.1		3.1M	6.5M (20 09)

MARCH — DATA SUMMARY — 46006

AVERAGE LATITUDE 48.7N — AVERAGE LONGITUDE 137.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	06.5	(13 15)	10.3	12.6	(31 00)	192	25
SEA TEMP (DEG C)	10.5	(11 18)	11.0	11.9	(22 00)	192	25
AIR-SEA TEMP (DEG C)	-04.2	(13 15)	-00.7	01.4	(28 03)	192	25
PRESSURE (MBAR)	1012.3	(13 15)	1026.2	1038.7	(2) 18)	192	25

WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS)						TOTAL	MEAN SPEED (KNOTS)	NO. OF OBS: 192
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	
N			7.1	12.0	3.6		18.8	16.7
NE			1.6	4.2	1.6		7.3	15.5
E				1.6			1.6	13.3
SE				1.0			1.0	17
S		.5					.5	2.0
SW			1.0	3.6	1.6		6.3	15.9
W		.5	14.1	18.2	5.7		38.5	13.9
NW		1.0	5.7	13..	5.7		26.0	15.5
CALM								
TOTAL		2.1	25.5	54.2	18.2		100.0	15.0

MAX WIND: SPEED: 30 KNOTS; DIRECTION: 310 DEG; DAY: 17; HOUR: 06

APRIL — DATA SUMMARY — 46006

AVERAGE LATITUDE 48.7N — AVERAGE LONGITUDE 137.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.0	(06 03)	10.2	12.7	(11 15)	150	19
SEA TEMP (DEG C)	10.5	(13 09)	10.8	11.4	(02 03)	150	19
AIR-SEA TEMP (DEG C)	-03.7	(06 03)	-00.6	02.1	(11 15)	150	19
PRESSURE (MBAR)	0997.5	(04 18)	1015.5	1032.8	(01 00)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS)						TOTAL	MEAN SPEED (KNOTS)	NO. OF OBS: 239
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	
N		.4	1.3	1.7	.8	2.1	6.3	23.6
NE			.8	.8			1.7	11.3
E								
SE				.8			.8	16.5
S				7.9	4.2		12.1	19.8
SW			1.7	16.3	7.1		25.1	17.7
W		.4	4.6	13.0	8.8		26.8	17.7
NW		.4	1.3	13.8	9.2	2.5	27.2	21.4
CALM								
TOTAL		1.3	9.6	54.4	30.1	4.6	100.0	19.1

MAX WIND: SPEED: 43 KNOTS; DIRECTION: 330 DEG; DAY: 13; HOUR: 21

MARCH — DATA SUMMARY — 46010

AVERAGE LATITUDE 46.2N — AVERAGE LONGITUDE 124.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.0	(15 18)	08.0	11.6	(02 21)	245	31
SEA TEMP (DEG C)	07.6	(16 06)	09.4	11.0	(02 21)	244	31
AIR-SEA TEMP (DEG C)	-05.9	(19 21)	-01.4	00.8	(01 00)	244	31
PRESSURE (MBAR)	0998.0	(13 03)	1017.2	1032.1	(27 18)	245	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS)						TOTAL	MEAN SPEED (KNOTS)	NO. OF OBS: 245
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	
N		2.0	3.3				5.3	4.5
NE		.4	.4				.8	3.5
E			5.7	5.7			11.4	10.6
SE		1.6	2.4	.8			4.9	5.9
S		.8	4.5	9.4	2.4	.4	17.6	15.5
SW		.8	6.1	8.2	1.6		16.7	12.1
W		.4	5.7	9.4	1.6		17.1	13.0
NW		1.6	9.4	12.7			23.7	10.8
CALM		2.4					2.4	.0
TOTAL		10.2	37.6	48.1	5.7	.4	100.0	11.3

MAX WIND: SPEED: 39 KNOTS; DIRECTION: 280 DEG; DAY: 13; HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 241

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		17.4	41.1	27.8	10.8	2.1	.8		2.7M	6.5M (13 12)

APRIL — DATA SUMMARY — 46010

AVERAGE LATITUDE 46.2N — AVERAGE LONGITUDE 124.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.4	(06 15)	09.9	12.1	(13 21)	239	30
SEA TEMP (DEG C)	08.0	(01 15)	10.5	12.6	(25 03)	239	30
AIR-SEA TEMP (DEG C)	-03.6	(07 15)	-00.6	04.6	(12 03)	239	30
PRESSURE (MBAR)	0994.0	(05 15)	1016.5	1029.0	(11 06)	239	30

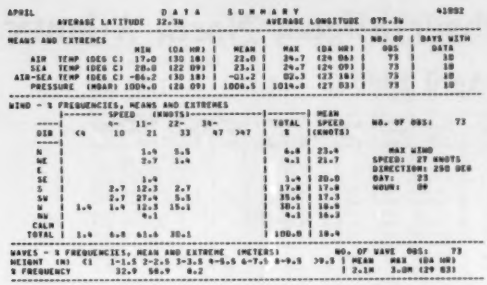
WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS)						TOTAL	MEAN SPEED (KNOTS)	NO. OF OBS: 239
DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	%	
N		.4	6.3	10.9	.8		18.4	12.2
NE		.8	2.5				3.3	5.4
E		.8	6.3	5.4			12.1	10.2
SE		1.7	2.9	2.1			6.7	8.4
S		1.7	8.0	13.8	3.8		24.3	15.1
SW		.4	5.9	9.6	2.1		13.8	12.8
W		1.7	3.3	2.9	.4		8.4	9.8
NW			5.4	6.7			12.1	10.9
CALM		.8					.8	.0
TOTAL		7.9	37.7	47.3	7.1		100.0	11.7

MAX WIND: SPEED: 29 KNOTS; DIRECTION: 180 DEG; DAY: 09; HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 194

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		13.2	36.6	38.6	10.8	.7			2.9M	6.5M (06 12)



APRIL — DATA SUMMARY — 41892

AVERAGE LATITUDE 32.3N — AVERAGE LONGITUDE 075.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	17.0	(30 18)	22.0	26.7	(24 06)	73	10
SEA TEMP (DEG C)	20.0	(22 09)	23.1	26.7	(24 09)	73	10
AIR-SEA TEMP (DEG C)	-06.2	(30 18)	-01.2	02.3	(23 18)	73	10
PRESSURE (MBAR)	1004.0	(28 09)	1008.5	1014.0	(27 03)	73	10

WIND - % FREQUENCIES, MEANS AND EXTREMES

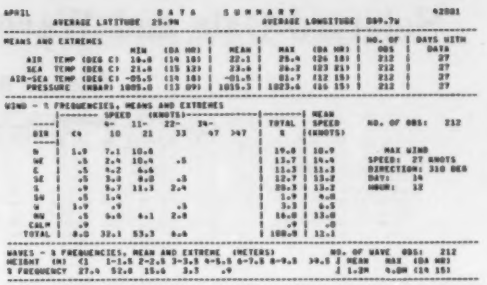
DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.4	5.5				6.8	23.4
NE		2.7	1.4				4.1	21.7
E								
SE		1.4					1.4	20.0
S		2.7	12.3	2.7			17.8	17.8
SW		2.7	27.4	5.5			35.6	17.3
W	1.4	1.4	12.3	19.1			33.1	18.5
NW			4.1				4.1	16.3
CALM								
TOTAL	1.4	8.2	61.6	28.1			100.0	18.4

NO. OF OBS: 73

MAX WIND
SPEED: 27 KNOTS
DIRECTION: 250 DEG
DAY: 23
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 73

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		32.9	56.9	8.2					2.1M	3.0M (29 03)



APRIL — DATA SUMMARY — 42881

AVERAGE LATITUDE 25.9N — AVERAGE LONGITUDE 089.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	18.8	(14 18)	22.1	25.4	(26 18)	212	27
SEA TEMP (DEG C)	21.6	(15 12)	23.6	26.2	(23 21)	212	27
AIR-SEA TEMP (DEG C)	-05.5	(14 18)	-01.5	01.7	(12 15)	212	27
PRESSURE (MBAR)	1005.8	(13 09)	1015.5	1023.6	(15 15)	212	27

WIND - % FREQUENCIES, MEANS AND EXTREMES

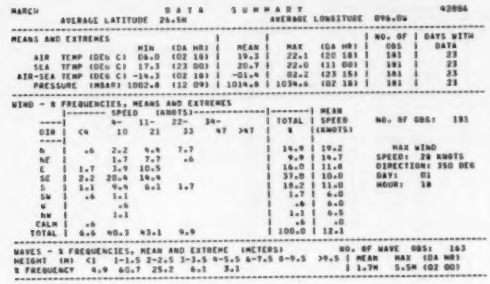
DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.9	7.1	10.8				19.8	18.9
NE	.5	2.4	10.4	.5			13.7	19.4
E	.5	4.2	4.6				11.3	13.3
SE	.5	5.8	8.0	.5			12.7	13.7
S	.9	9.7	11.3	2.4			28.3	15.2
SW	.5	1.4					1.9	9.8
W	1.9	.9		.5			3.3	6.5
NW	.5	6.6	6.1	2.8			16.0	13.8
CALM	.9						.9	.0
TOTAL	8.0	32.1	53.3	6.6			100.0	13.1

NO. OF OBS: 212

MAX WIND
SPEED: 27 KNOTS
DIRECTION: 310 DEG
DAY: 14
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 212

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	27.4	52.8	15.6	3.3	.9				1.2M	4.0M (14 15)



MARCH — DATA SUMMARY — 42884

AVERAGE LATITUDE 26.5N — AVERAGE LONGITUDE 079.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.0	(02 18)	19.2	22.1	(20 18)	181	23
SEA TEMP (DEG C)	17.3	(23 00)	20.7	22.0	(11 00)	181	23
AIR-SEA TEMP (DEG C)	-14.3	(02 18)	-01.4	02.2	(23 15)	181	23
PRESSURE (MBAR)	1002.8	(12 09)	1014.6	1034.6	(02 15)	181	23

NO. OF OBS: 181

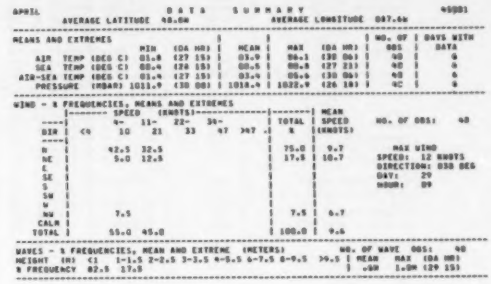
WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.6	2.2	9.4	7.7			19.9	19.2
NE		1.7	7.7	.6			9.9	16.7
E	1.7	3.9	10.5				16.0	11.6
SE	2.2	28.4	14.4				37.0	10.0
S	1.1	9.4	6.1	1.7			18.2	11.0
SW	.6	1.1					1.7	6.0
W		.6					.6	6.0
NW		1.1					1.1	6.5
CALM	.6						.6	.0
TOTAL	6.6	48.3	43.1	9.9			100.0	12.3

MAX WIND
SPEED: 28 KNOTS
DIRECTION: 350 DEG
DAY: 01
HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 163

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	4.9	40.7	25.2	6.1	3.1				1.7M	5.5M (02 00)



APRIL — DATA SUMMARY — 45881

AVERAGE LATITUDE 40.6N — AVERAGE LONGITUDE 087.6W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.8	(27 15)	03.9	06.1	(30 06)	90	6
SEA TEMP (DEG C)	08.4	(26 15)	08.5	08.8	(27 21)	90	6
AIR-SEA TEMP (DEG C)	01.4	(27 15)	03.4	05.6	(30 06)	90	6
PRESSURE (MBAR)	1011.9	(30 00)	1018.4	1022.9	(26 18)	90	6

NO. OF OBS: 90

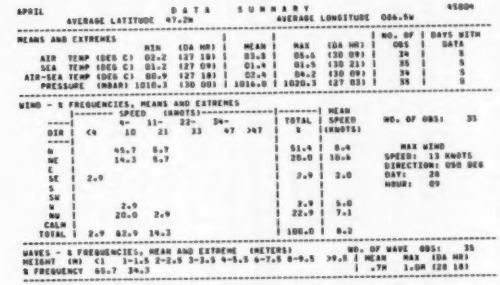
WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		42.5	32.5				75.0	9.7
NE		5.0	12.5				17.5	10.7
E								
SE								
S								
SW								
W								
NW		7.5					7.5	6.7
CALM								
TOTAL		55.0	45.0				100.0	9.6

MAX WIND
SPEED: 12 KNOTS
DIRECTION: 030 DEG
DAY: 29
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 40

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	82.5	17.5							.4M	1.0M (29 15)



APRIL — DATA SUMMARY — 41884

AVERAGE LATITUDE 47.2N — AVERAGE LONGITUDE 084.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	02.2	(27 18)	03.5	05.6	(30 09)	34	5
SEA TEMP (DEG C)	01.2	(27 09)	01.4	01.5	(30 21)	35	5
AIR-SEA TEMP (DEG C)	00.9	(27 18)	02.4	04.2	(30 09)	34	5
PRESSURE (MBAR)	1016.3	(30 00)	1016.8	1020.5	(27 03)	35	5

NO. OF OBS: 35

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		45.7	8.7				51.4	8.4
NE		14.3	5.7				20.0	10.6
E								
SE	2.9						2.9	2.0
S								
SW								
W		2.9					2.9	5.0
NW		20.0	2.9				22.9	7.1
CALM								
TOTAL	2.9	82.9	14.3				100.0	8.2

MAX WIND
SPEED: 13 KNOTS
DIRECTION: 050 DEG
DAY: 28
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 35

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	65.7	34.3							.7M	1.0M (28 18)

Continued from page 374.

MIN WOO No. 11 sank near 28°N, 123°E, after striking an unknown object in heavy weather on the 10th. All the crew was rescued. The 6,573-ton PANamanian OCEAN PROGRESS shipped heavy seas on the 16th, flooding the steering room and causing other damage. The Thai JUTHA RAJATA was at Kobe on the 28th with weather damage. That day the fishing boat GYOSEI MARU capsized and sank off Cape Nojima. Only 2 of 23 crewmembers were rescued. A construction boat, KYOEI MARU also capsized with the four crewmen missing.

Other Casualties--Storms hit Bangladesh on the 19th and 20th. A motor launch carrying 300 people capsized with 200 unaccounted for. The drilling vessel REGIONAL ENDEAVOUR was damaged in heavy weather off Dampier on the 20th when an anchor chain broke.

Selected Gale and Wave Observations, North Atlantic

March and April 1980

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves*			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH ATLANTIC OCEAN		MAR.																
GULF TRADER	KRHI	1	36.5 N	60.3 W	00	29	25	10 NM	02	1006.1	16.7	18.3	6	8	27	6	32.5
EXXON NEWARK	KEAF	2	27.7 N	92.2 W	00	34	95	5 NM	02	1020.0	13.0	21.2	11	14.5			
AMERICAN HERITAGE	KVFN	2	37.1 N	72.1 W	18	04	40	5 NM	80	1007.5	13.3	17.7	8	23	05	8	32.5
EXXON HUNTINGTON	KEAJ	3	30.0 N	80.4 W	00	28	45	5 NM	11	1015.9	6.0	18.9			28	9	6.5
LAKE SHASTA	SMQL	3	36.9 N	64.4 W	00	18	50	5 NM	62	1009.9	17.0		6	23			
CHANCELLORSVILLE	KUCG	3	34.2 N	75.5 W	06	32	60	200 YD	82	0999.3	3.4	22.3	8	32.5	32	8	32.5
MORMACSKY	WMRQ	3	36.7 N	73.0 W	12	05	70	50 YD	65	0996.9	6.6	18.5	XX	23	05	8	41
EL PASO ARZEW	KHKB	3	32.3 N	70.5 W	12	26	63	5 NM	02	0998.5	11.7	17.7	13	34.5			
OVERSEAS ALEUTIAN	KFGK	3	33.9 N	73.9 W	12	29	45	.25 NM	44	1003.0	5.5	21.2	7	13	29	12	19.5
MARIA U	SMUC	3	31.9 N	69.6 W	12	24	N 50	5 NM	80	1002.0	13.2	22.0	8	13	24	12	13
BUNGA CHEMPAKA	9MTR	3	28.4 N	70.1 W	12	24	45	5 NM	02	1009.0	18.0	22.0	4	26			
AMERICAN LEGION	WZJC	3	36.8 N	73.8 W	12	36	48	1 NM	22	1003.9	0.6	15.0	7	14.5	05	8	26
ARCO ENTERPRISE	KALC	3	30.1 N	73.3 W	18	33	40	2 NM	21	1015.9	12.0	19.5	13	41			
ARCO PRESTIGE	WLDU	3	34.5 N	74.0 W	18	36	55	2 NM	16	1014.6	7.0	21.0	5	8	36	11	23
BAYAMON	WIAG	3	34.7 N	72.4 W	18	35	35	2 NM	42	0997.6	10.0	18.8	10	32.5	35	11	49
BAYAMON	WIAG	4	32.7 N	71.7 W	00	35	43	2 NM	42	1019.6	10.0	18.8	10	32.5	35	12	29.5
GULF TRADER	KRHI	4	37.8 N	67.9 W	00	36	50	5 NM	05	0999.0	6.2	20.0	6	19.5	36	7	19.5
T F L LIBERTY	9VDD	4	45.8 N	39.9 W	00	22	N 50	5 NM	02	1002.0	13.0	12.0					
LASH ITALIA	WJAJ	4	36.2 N	56.6 W	12	23	45	5 NM	03	1003.5	14.5	17.3	6	14.5			
SEALAND RESOURCE	WJKD	4	40.5 N	62.7 W	18	36	41	10 NM	03	1012.8	7.5	11.7	4	8	03	8	11.5
EXPORT FREEDOM	WCJS	4	36.9 N	62.1 W	18	32	30	5 NM	01	1012.0	10.0	18.3	6	10	31	12	32.5
MORMACSTAR	KGDF	4	36.0 N	59.5 W	18	30	45	5 NM	02	1010.8	13.3	17.8	3	5	30	10	14.5
MANZANARES	GTOG	4	41.1 N	53.8 W	18	21	45	5 NM	01	0988.2	14.5	15.5	4	13	25	7	16.5
PIONEER CONTENDER	WMEC	7	48.4 N	11.3 W	12	29	55	5 NM	02	1002.5	10.0	13.3	8	36			
SNOW STORM	SGXA	7	47.5 N	16.0 W	18	31	40	> 25 NM	02	1018.0	12.0	12.0	XX	19.5	32		32.5
T F L INDEPENDENCE	9VVK	7	45.2 N	12.8 W	18	32	N 52	10 NM	01	1017.0	13.0	11.0	7	5	28	9	14.5
APCO SAG RIVER	WLDF	9	34.2 N	74.4 W	06	22	N 42	2 NM	97	1009.5	20.0	20.0					
BAY	WGRC	12	38.8 N	57.7 W	00	21	45	5 NM	00	1008.5	16.8	19.4				/	
SEALAND MARKET	WJVG	12	38.8 N	69.0 W	00	23	45	5 NM	25	0999.7	9.0	4.5					
VIGOROUS WMEC-627	NOSP	12	43.0 N	67.5 W	06	29	N 46	2 NM	01	0999.3	- 1.0		2	6.5	27	6	5
BAYAMON	WIAG	12	22.5 N	68.4 W	12	24	10	10 NM	15	1017.3	26.7	22.8	2	1.5	14	10	34.5
ADM WM M CALLAGHAN	KGYE	12	40.5 N	68.4 W	12	28	43	> 25 NM	02	1013.0	- 1.0	1.0	8	10	28	11	11.5
THOMAS MAERSK	OXOX	12	40.1 N	57.7 W	18	25	45	10 NM	02	1008.5	16.2		7	11.5			
NANTUCKET II	WNBN	12	40.5 N	69.5 W	23	31	N 45	10 NM	01	1016.3	1.5		5	5	35	< 6	14.5
THOMAS MAERSK	OXOX	13	40.1 N	59.1 W	00	26	47	10 NM	15	1009.5	12.4		5	24.5			
HOWARD G VESPER	6ZOD	13	32.6 N	77.1 W	12	25	N 46	.25 NM	97	1007.5	18.3	22.2					
EXXON HUNTINGTON	KEAJ	14	38.9 N	73.6 W	00	09	45	2 NM	52	1009.8	11.0	10.6	5	6.5	09	13	13
GOLDEN GATE	KIOH	14	35.4 N	70.8 W	18	26	45	5 NM	07	1008.1	16.1	15.6	6	6.5	23	9	14.5
NANTUCKET II	WNBN	15	40.5 N	69.5 W	08	28	N 45	5 NM	01	1008.5	5.0		5	5	26	< 6	14.5
RODRIGUES CABRILHO	CSDU	15	37.8 N	03.5 W	12	30	N 45	5 NM	02	1024.7	9.0	20.0		19.5			
VALLEY FORGE	WRGL	15	37.0 N	74.0 W	18	34	45	10 NM	02	1026.8	12.0	19.5	4	6.5	34	< 6	5
NANTUCKET II	WNBN	16	40.5 N	69.5 W	02	29	N 41	10 NM	01	1017.6	1.7		4	5	31	< 6	11.5
PARWA	LMPH	16	38.3 N	24.6 W	12	36	N 42	5 NM	28	1020.5	13.5	18.5	6	13	36	8	16.5
LASH ITALIA	WJAJ	16	37.5 N	61.4 W	12	32	42	5 NM	18	1016.9	10.0	18.4	2	13	32	< 6	14.5
ADM WM M CALLAGHAN	KGYE	18	36.6 N	11.2 W	12	09	45	5 NM	02	1024.0	7.8	8.9	5	14.5	05	8	16.5
T F L LIBERTY	9VDD	19	49.2 N	23.2 W	12	04	N 48	10 NM	02	1019.0	12.0	11.0					
SEALAND VENTURE	KLJN	20	50.1 N	11.9 W	12	04	45	5 NM	02	1013.2	5.6	10.0	5	11.5	06	< 6	14.5
TRANSCOLUMBIA	KPGQ	20	49.4 N	07.8 W	12	04	45	2 NM	02	1010.0	6.1	10.0	2	10	04	< 6	19.5
SANTA ISABEL	WLGT	22	34.7 N	75.2 W	06	29	48	10 NM	01	1001.0	-						
NANTUCKET II	WNBN	22	40.5 N	69.5 W	08	08	N 48	2 NM	81	0986.1	3.9		4	6.5	10	6	13
C V STAGHOUND	KAFQ	22	40.3 N	72.2 W	18	05	50	2 NM	02	0999.6	3.3	6.7	8	19.5	05	12	19.5
PACEMAKER	ELUU	23	39.5 N	69.4 W	00	03	N 55	.5 NM	02	0999.8	6.0		6	14.5	04	8	29.5
BARWA	LMPH	23	33.5 N	62.2 W	06	25	N 60	5 NM	80	0999.1	15.0	20.0	8	23			
HARDANGER	LFFG	23	35.9 N	55.7 W	12	23	41	5 NM	02	0989.0	18.5	18.0			23	11	10
PIONEER CONTENDER	WMEC	23	39.9 N	68.3 W	12	34	50	2 NM	64	1000.7	12.3	21.7	6	19.5	36	10	29.5
JOSEPH LYKES	WHTR	23	32.8 N	50.7 W	12	30	50	.5 NM	00	1003.0	19.5	19.5	4	11.5	18	7	10
BARTHNEWYDD	GUJR	23	43.6 N	44.9 W	18	11	50	2 NM	54	0993.0	13.0	9.0	2	10	13	< 6	32.5
SARWA	LMRN	24	33.3 N	64.7 W	12	34	N 45	5 NM	02	1005.0	14.0	20.0	2	16.5	32	12	19.5
MORMACARGO	WMRG	24	35.6 N	71.6 W	06	31	15	10 NM	02	1011.7	12.2	22.2	3	3	09	8	32.5
HARDANGER	LFFG	24	32.9 N	58.8 W	12	27	58	2 NM	80	1000.3	18.0	17.0			27	12	13
SEALAND VENTURE	KLJN	24	41.9 N	63.5 W	12	01	50	5 NM	02	0995.7	2.5	8.0	5	14.5	01	< 6	16.5
DEFIANCE	KRRS	24	41.5 N	64.3 W	12	36	48	2 NM	10	1004.0	3.3	7.2	6	19.5	36	6	19.5
PACEMAKER	ELUU	24	39.6 N	65.9 W	12	34	N 46	2 NM	02	1007.0	9.0		5	11.5	01	6	19.5
AMERICAN LEADER	KFEJ	24	43.2 N	62.1 W	12	01	47	5 NM	41	1001.0	3.3	6.0	8	26	01	8	26
EL PASO ARZEW	KHKB	24	31.2 N	50.5 W	18	25	41	10 NM	03	0999.7	18.9	19.4	2	11.5	25	>13	31
T F L INDEPENDENCE	9VVK	24	46.1 N	40.0 W	18	11	N 41	2 NM	50	0992.0	12.5	13.0	8	16.5	10	9	16.5
COVADONGA	EHOV	25	40.5 N	58.8 W	06	32	45	10 NM	81	1004.0	9.0		6	19.5			
EL PASO ARZEW	KHKB	25	31.5 N	52.6 W	06	28	N 47	10 NM	01	1002.8	18.3	18.3			27	9	34.5
GULF SHIPPER	KEMP	25	34.8 N	34.4 W	22	25	45	2 NM	18	0993.2	20.0	15.7	7	19.5	25	8	13
AMERICAN ACE	KFCV	25	46.0 N	37.5 W	18	07	42	2 NM	25	0990.2	10.6	13.4	6	24.5	07	6	24.5
T F L INDEPENDENCE	9VVK	25	48.1 N	35.2 W	18	06	N 47	10 NM	02	0995.0	11.0	11.0	8	16.5	07	10	16.5
T F L INDEPENDENCE	9VVK	26	48.8 N	33.6 W	00	06	N 48	10 NM	01	0996.0	10.0	11.0		13	06	8	13
GULF SHIPPER	KEMP	26	34.5 N	34.7 W	00	24	45	2 NM	01	1000.4	19.5	15.7	13	24.5			
EL PASO ARZEW	KHKB	26	30.8 N	62.5 W	18	28	46	10 NM	03	1009.8	17.8	18.3	3	8	29	< 6	14.5
SEALAND RESOURCE	WJKD	27	42.9 N	45.3 W	00	09	45	10 NM	01	1000.5	13.0	11.2					
AMERICAN ARCHER	KFCS	27	40.5 N	56.4 W	18	07	42	10 NM	03	0999.0	12.2	16.7	5	19.5	07	< 6	24.5
AMERICAN ARCHER	KFCS	28	40.9 N	55.1 W	00	04	55	10 NM	02	1005.0	9.0	14.5	4	31	08	< 6	57
T F L INDEPENDENCE	9VVK	28	50.0 N	09.7 W	12	24	N 60	2 NM	03	0986.0	11.0	9.0					
BUNGA CHEMPAKA	9MTR	28	32.3 N	58.2 W	12	35	41	5 NM	25	1008.5	16.0	21.0	11	23			
ADM WM M CALLAGHAN	KGYE	28	49.8 N	17.4 W	18	05	45	> 25 NM	02	1014.5	6.6	6.9	2	1.5	01	10	11.5
SEALAND PACER	KSLB	28	38.1 N	53.4 W	18	36	N 45	5 NM	60	1001.7	18.3	17.3	6	14.5	36	8	26
PACEMAKER	ELUU	28	42.0 N	45.8 W	21	04	N 53	1 NM	02	0999.5	11.6		6	11.5	04	9	32.5
PACEMAKER	ELUU	29	42.2 N	45.7 W	00	04	N 53	1 NM	02	0996.0	10.0	13.0	6	11.5	04	9	32.5
SEALAND PACER	KSLB	29	39.2 N	54.4 W	00	36	N 45	5 NM	02	1007.8	11.0	14.2	7	24.5	36	8	29.5
T F L LIBERTY	9VDD	29	50.1 N	08.5 W	00	29	N 50	5 NM	02	1006.0	10.0	10.0					
AMERICAN ARCHER	KFCS	29	44.1 N	47.2 W	06	36	35	10 NM	02	1007.5	4.4	1.7	4	29.5	36	< 6	41
ENVIRONMENTAL BUOYS																	
41001		3	34.7 N	72.3 W	09	18	N 61			976.7	7.9	17.8	9	31			
41001		13	34.7 N	72.3 W	18	13	N 49			1013.4	14.4	19.9	6	11.5			
41001		22	34.7 N	72.3 W	21	30	N 44			1001.3	9.3	18.4	9	24.5			
41001		23	34.7 N	72.3 W	00	31	N 45			1003.5	9.2	18.3	9	24.5			
44004		3	39.0 N	70.0 W	11	02	N 44			1002.0	1.8	12.6	8	23			
44004		14	39.0 N	70.0 W	21	26	N 42			1003.7	7.5	14.4	8	19.5			
44004		22	39.0 N	70.0 W	23	03	N 47			997.7	5.3	13.7	9	28			
44004		23	39.0 N	70.0 W	00	03	N 44			999.4	5.0	13.6	9	26			
44005		14	42.7 N	68.3 W	11	11	N 41			1005.5	3.8	5.3	7	18			
44005		22	42.7 N	68.3 W	11	10	N 41			1000.9	1.9	5.4					

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb	Temperature °C		Sea Waves?			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.	
NORTH ATLANTIC OCEAN		APR.																
EXXON NEWARK	WEAF	1	35.0 N	74.2 W	08	27	45	10 NM	02	1025.1	21.6	25.8	11	13				
MARIAS TAO-57	WZWL	1	37.2 N	65.9 W	18	03	M 53	5 NM	07	1021.3	14.4	17.8	9	6.5	01	9	14.5	
OLGA TOPIC	ABEE	1	33.4 N	68.1 W	18	36	45	5 NM	03	1011.6	18.0	20.6	7	14.5	36	7	14.5	
DEFIANCE	KRBS	2	40.5 N	48.0 W	12	34	48	2 NM	07	1003.0	5.5	15.5	2	0	34	< 6	10	
DAWN	WLDP	2	37.2 N	44.6 W	21	33	45	1 NM	10	1000.0	12.7	17.2	4	5	24	6	10	
DAWN	WLDP	3	38.1 N	41.1 W	06	34	45	10 NM	01	1009.8	12.2	17.7	9	6.5	32	9	11.5	
SEALAND VENTURE	KLJH	3	41.5 N	37.4 W	06	35	50	5 NM	50	0992.7	10.5	15.0	7	10	35	7	10.8	
LAKE SHASTA	SMOL	4	37.3 N	54.0 W	00	27	50	5 NM	95	1007.9	13.0		6	11.5				
YOUNG AMERICA	WGLW	4	43.4 N	47.6 W	18	36	50	2 NM	47	1004.5	2.8	1.6	8	18	01	10	19.5	
LASH ATLANTICO	WEZU	5	37.7 N	71.0 W	00	21	45	2 NM	91	0997.0	19.4	17.2	10	8	21	>13	13	
ALLTRANS EXPRESS	9VPU	5	39.2 N	60.4 W	12	22	M 50	.5 NM	07	1003.5	17.0	17.2	5	3	20	< 6	13	
GULF TRADER	KRWI	5	37.0 N	40.5 W	18	34	30	10 NM	50	1005.8	16.2	17.2	7	8	28	6	32.5	
ALLTRANS EXPRESS	9VPU	6	40.8 N	54.9 W	00	20	M 44	1 NM	61	1003.0	16.0	16.2						
TFL DEMOCRACY	9VPB	15	45.4 N	45.9 W	00	33	M 45	2 NM	61	0995.8	5.3	4.9						
STONEWALL JACKSON	KDDW	21	43.1 N	45.2 W	06	08	M 42	2 NM	53	1009.0	10.4	13.9	6	5	08	10	10	
JUTHLANDIA	ELXU	23	29.6 N	67.4 W	00	27	41	5 NM	02	1004.5	21.0	17.4						
SEALAND PACER	KSLB	23	43.0 N	61.0 W	06	10	M 44	2 NM	02	0997.6	7.2	1.1	9	14.5				
AMERICAN ACE	KFCV	23	43.1 N	60.2 W	12	09	47	1 NM	45	0997.0	14.0	5.6	6	18	11	6	19.5	
GREAT LAKES VESSELS																		
PHILIP R CLARKE	9829	9	47.6 N	86.0 W	18	06	M 43	10 NM	02		0.8	2.0	6	6.5				
JOHN DYKSTRA	9852	16	44.5 N	82.7 W	06	36	M 45	10 NM	01		- 3.0	1.0	8	8				
JOHN DYKSTRA	9852	23	46.9 N	85.5 W	06	33	M 46	10 NM	02		7.0	4.0	7	6.5				
ENVIRONMENTAL BUOYS																		
44004		1	39.0 N	70.0 W	09	02	M 41			1003.0	7.7	10.2	8	18				

\+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

Selected Gale and Wave Observations, North Pacific

March and April 1980

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves*			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH PACIFIC OCEAN		MAR.																
SEALAND MCLEAN	WHGA	1	44.5 N	156.1 E	00	32	45	5 NM	02	1003.0	1.7	0.0	8	16.5	32	8	19.5
SHUNWIND	ELIQ	1	42.5 N	141.2 W	06	18	M 15	10 NM	60	1001.0	9.5	12.0	4	6.5	23	8	32.5
PACIFIC VENTURE	HOVS	1	49.4 N	167.1 W	12	27	M 45	2 NM	81	0978.0	6.0	4.0	12	23	27	12	24.5
SEAWAY EXPRESS	DOFO	1	39.2 N	136.3 E	18	32	47	5 NM	02	1011.0	2.8	10.5		16.5			
MAYA PIONEER	JLAX	2	32.2 N	151.6 E	00	19	M 50	2 NM	02	1006.8	18.0	18.0	5	6.5	21	< 6	6.5
SEALAND MCLEAN	WHGA	2	39.2 N	148.4 E	00	28	45	10 NM	02	0999.5	3.3	10.0	7	16.5	29	8	19.5
IRIS ISLAND	JPKG	2	42.3 N	151.4 E	06	27	M 46	5 NM	04	0990.0	1.0	4.0	4	6.5	26	7	10
MORNING GLORY	6ZUU	2	44.9 N	151.0 E	06	26	M 45	2 NM	70	0978.5	0.0	2.0	7	6.5	26	9	11.5
PACIFIC VENTURE	SLKH	2	40.5 N	158.9 E	12	26	M 42	10 NM	01	1000.0	6.0	9.0	5	6.5	27	8	16.5
MILLER FREEMAN	WTDM	2	56.5 N	154.9 W	18	10	M 45	.5 NM	28	0990.2	3.5	3.8		3	09	6	10
MING HOPE	BLHF	2	37.7 N	171.7 W	18	29	M 41	10 NM	02	1018.0	10.0	12.0	9	5	28	7	11.5
SILVER PHOENIX	OSNW	2	52.1 N	151.9 W	18	17	M 42	10 NM	03	0989.5	4.5		6	13	16	10	23
PACIFIC VENTURE	HOVS	2	49.0 N	177.4 W	18	25	M 45	1 NM	40	0993.0	5.0	4.0	12	23	25	12	24.5
DELTA AFRICA	WNCS	2	15.9 N	94.1 W	18	36	66	2 NM	02	1007.8	23.6	20.5	4	8	36	< 6	8
NEIYO	JKHQ	3	48.7 N	174.0 W	00	29	M 45	5 NM	03	0998.5	7.0	5.0	13	11.5	29	13	13
WALTER RICE	KCSE	3	15.8 N	94.0 W	06	35	55	5 NM	05	1015.2	23.9	18.8			35	9	16.5
AMERICAN LIBERTY	WZJD	3	13.5 N	94.4 W	06	35	45	5 NM	02	1013.3	20.6	26.7	5	19.5	35	9	24.5
OVERSEAS JUNEAU	WNKD	3	15.0 N	95.7 W	06	20	60	5 NM	25	1014.6	20.6	17.3	5	8	20	9	29.5
BREWSTER	HJNF	3	45.3 N	151.1 E	12	27	M 45	10 NM	01	1008.0	- 4.0	2.0	5	6.5			
SHUNWIND	ELIQ	3	37.0 N	151.9 W	18	29	M 40	10 NM	02	1014.5	10.5	13.0	7	11.5	29	8	46
SHUNWIND	ELIQ	4	36.9 N	152.5 W	00	28	M 33	10 NM	02	1016.0	13.5	12.0	6	10	29	8	41
EASTERN RIVER	GSCS	5	34.5 N	163.8 E	00	22	M 42	2 NM	21	1006.0	17.0	14.0	10	13	24	12	23
PACIFIC VENTURE	HOVS	5	39.2 N	166.5 E	06	27	M 45	10 NM	65	0997.9	9.0	9.0	12	26	27	>13	29.5
PACIFIC VENTURE	SLKH	5	44.6 N	177.1 W	18	19	M 45	5 NM	60	0999.0	7.0	9.0	XX	1.5	19	7	18
CALIFORNIAN	KPZW	6	33.1 N	134.8 W	00	32	45	10 NM	02	1017.0	14.4	18.3	6	14.5			
ALLTRANS EXPRESS	9VPU	7	50.3 N	154.9 W	12	15	M 52	2 NM	50	1008.5	5.5	5.0					
BUNGA MELAWIS	9MUT	8	35.5 N	141.3 E	00	31	M 45	5 NM	01	1002.0	8.0	14.0	8	26			
EASTERN RIVER	GSCS	8	34.6 N	145.8 E	00	13	M 50	1 NM	21	0994.0	15.0	14.0	10	19.5	XX	>13	23
PACIFIC VENTURE	HOVS	8	36.3 N	149.8 E	00	12	M 44	1 NM	63	0996.8	12.0	18.0	12	23	12	12	24.5
RIA LUNA	DZNR	8	35.2 N	151.2 E	06	15	60	200 YD	97	1000.5	12.0	16.0	7	13	13	8	24.5
AMERICAN LANCER	WZJD	8	35.6 N	142.9 E	06	33	60	2 NM	02	1000.0	10.6	16.7	10	14.5			
PRESIDENT TYLER	WEZM	9	31.1 N	158.9 E	06	27	45	5 NM	03	1002.9	18.9	16.1	3	14.5	27	< 6	21
MOBIL ARCTIC	KSPY	10	52.8 N	137.2 W	00	25	M 45	10 NM	02	1005.9	5.6	5.6	3	6.5	28	6	10
PRESIDENT FILLMORE	KROH	10	38.5 N	150.2 E	06	14	45	5 NM	53	0988.0	13.3	12.2	8	10	14	10	19.5
CAMARA	OXKV	10	39.1 N	147.7 E	06	29	M 48	5 NM	21	0987.2	9.2	14.0	5	6.5	15	12	19.5
GENISTA	H3KV	10	39.5 N	153.0 E	06	12	M 45	5 NM	02	0999.5	13.0	12.0	4	8	12	9	16.5
CRESSIDA	3FTB	10	38.5 N	150.0 E	06	11	M 42	1 NM	58	0990.0	13.0	14.0	5	21	11	< 6	19.5
MARCONA EXPORTER	ELEC	10	32.3 N	149.7 E	06	21	41	5 NM	62	0999.8	18.5	17.0	8	16.5	21	8	16.5
VAN CONQUEROR	A8IB	10	36.9 N	142.9 E	06	32	M 45	5 NM	02	1000.0	10.0	12.0	6	19.5	31	8	19.5
JAPAN CAOBO	SMKV	10	38.2 N	147.7 E	12	33	50	2 NM	03	0998.0	8.0	15.0	6	16.5			
BELLMAN	9VUP	10	42.8 N	147.7 E	12	27	M 42	5 NM	74	0982.0	3.0	4.0	6	13	15	9	19.5
EASTERN DIAMOND	HODT	10	40.7 N	146.3 E	12	32	M 55	2 NM	03	0995.5	7.0	10.0	7	13	32	7	23
SUNNY PIONEER	H3SY	10	41.8 N	152.1 E	18	28	M 50	.5 NM	05	0987.9	3.0	4.0	8	29.5	28		29.5
WASHINGTON WOOD	JEOV	10	41.3 N	148.8 E	18	27	M 60	200 YD	07	0991.0	0.0	1.5	XX	16			
SUNNY PIONEER	H3SY	11	42.6 N	154.2 E	00	25	M 38	.25 NM	05	0989.1	2.0	5.0	8	41	25	8	41
EASTERN DIAMOND	HODT	11	39.2 N	145.3 E	00	19	M 55	5 NM	03	1004.5	4.0	10.0	6	10	19	7	19.5
PRESIDENT MADISON	WCIP	11	42.5 N	149.7 E	00	25	55	5 NM	84	0995.6	- 1.1	0.6	9	6.5	25	8	11.5
BELLMAN	9VUP	11	41.8 N	146.5 E	00	26	M 48	5 NM	02	0992.0	3.5	4.0	7	16.5	29	9	32.5
JADE BOUNTY	ZFCB	11	22.9 N	156.2 W	00	09	28	10 NM	02	1021.0	24.0	25.0	3	13	09	8	32.5
JAPAN CAOBO	SMKV	11	39.0 N	146.5 E	06	28	45	5 NM	68	1002.5	2.0	12.0	6	16.5			
BELLMAN	9VUP	11	41.1 N	146.7 E	06	26	M 65	2 NM	02	0992.0	0.0	4.0	7	16.5	27	12	29.5
ORIENTAL SOVEREIGN	ABUH	11	44.8 N	151.1 E	06	25	M 50	< 50 YD	12	0975.3	- 3.0	1.0	7	18	25	7	18
SEALAND COMMERCE	WEUJ	11	46.7 N	167.0 E	06	12	45	2 NM	61	0997.2	2.2	1.7	6	10	12	8	16.5
CAMARA	OXKV	11	42.7 N	155.1 E	12	24	M 46	10 NM	72	0991.2	2.6	8.0	10	19.5			
UNITED SEA ANGEL	3EEW	11	43.6 N	179.0 W	12	09	M 42	2 NM	02	1016.0	7.5	2.0					
WASHINGTON WOOD	JEOV	11	39.3 N	145.7 E	18	27	M 60	.5 NM	02	1003.5	2.0	1.0	XX	16.5	27	8	16.5
WASHINGTON WOOD	JEOV	12	38.7 N	144.8 E	00	27	M 65	5 NM	03	1007.0	2.2	1.2	XX	18	27	6	18
EASTERN DIAMOND	HODT	12	36.8 N	144.3 E	00	27	60	10 NM	02	1013.5	6.0	7.0	XX	16	27	6	16.5
PRESIDENT MADISON	WCIP	12	39.0 N	147.0 E	00	34	45	10 NM	18	1003.5	6.1	10.6	4	6.5	29	10	11.5
BELLMAN	9VUP	12	40.2 N	144.9 E	00	28	M 55	2 NM	68	1003.0	0.0	4.0	7	16.5	29	< 6	29.5
ORIENTAL SOVEREIGN	ABUH	12	46.7 N	156.6 E	00	20	M 44	10 NM	26	0981.0	- 1.0	1.0	7	16.5	28	7	16.5
GRAND GLOBE	6ZON	12	48.7 N	154.4 E	02	15	M 42	200 YD	48	0972.0	- 1.0	0.0	10	19.5	17	9	16.5
TONCI TOPIC	ELKX	12	31.8 N	157.4 E	06	24	42	2 NM	62	1007.0	17.5	17.0	6	8	31	11	14.5
GREAT OCEAN	JKJT	12	37.4 N	156.1 E	11	27	M 45	10 NM	02	1005.0	9.0	15.0	8	16.5	27	9	19.5
QUEENS WAY BRIDGE	JMJE	13	53.9 N	179.9 E	00	13	M 42	5 NM	02	1019.0	2.5	3.0	5	10	16	7	13
AMERICA SUN	WNEJ	13	47.0 N	130.7 W	00	26	M 56	2 NM	07	0985.0	8.2	7.2	3	24.5	27	6	29.5
PRESIDENT JOHNSON	WHMS	13	54.4 N	160.7 W	00	33	45	10 NM	03	1024.2	- 2.8	2.2	7	14.5			
ALEUTIAN DEVELOPER	WJPL	13	56.6 N	155.2 W	18	31	M 44	10 NM	26	1011.0	- 6.4	0.0	5	10	28	8	14.5
TONCI TOPIC	ELKX	14	32.8 N	145.2 E	12	20	45	5 NM	62	1000.0	18.0	18.0	8	14.5			
PRESIDENT GRANT	WEZD	14	35.7 N	150.1 E	18	18	M 55	5 NM	82	0991.9	15.0	14.4	5	14.5	18	6	26
ANNA MAERSK	OVNS	14	37.1 N	152.7 E	18	17	43	1 NM	63	0986.0	12.5	16.0	11	16.5			
SHUNWIND	ELIQ	14	34.9 N	154.2 E	00	20	M 50	2 NM	07	0997.5	16.0	17.0	6	23	20	6	36
SHUNWIND	ELIQ	15	34.8 N	154.0 E	00	23	M 48	5 NM	07	0998.4	17.5	17.0	6	23	23	6	36
PRESIDENT GRANT	WEZD	15	35.8 N	152.0 E	00	28	M 45	10 NM	01	0995.0	13.9	15.0	5	14.5	28	7	32.5
SEALAND FINANCE	WJKG	15	35.8 N	158.3 E	00	20	55	5 NM	62	0999.0	14.4	12.8	5	13	20	7	19.5
HOEGH MIRANDA	LIQZ	15	41.2 N	157.9 E	03	19	M 63	2 NM	06	0963.0	7.0	6.0	2	10	18	6	13
STAR DOVER	LEQY	15	35.7 N	162.5 E	06	21	47	2 NM	62	0998.0	15.0						
PRESIDENT JEFFERSON	WPEE	15	39.6 N	156.0 E	06	34	50	2 NM	55	0988.0	4.4	7.2	XX	11.5	34		16.5
TYSON LYKES	WSCJ	15	35.9 N	165.6 E	06	22	50	2 NM	81	0992.8	16.7	13.9	7	16.5	28	10	10
WESER EXPRESS	DLDE	15	37.1 N	166.0 E	12	17	48	.25 NM	62	0992.4	13.1	12.5	6	14.5	18		16.5
PAN WESTERN	D7SF	16	43.6 N	170.7 E	00	21	43	.5 NM	07	0981.0	3.0	4.0	14	21	21	13	23
BRILLIANT STAR	SMSK	16	50.7 N	170.6 E	00	09	M 55	50 YD	38	0985.0	0.0	6.0	17	19.5	09	9	11.5
PRESIDENT JEFFERSON	WPDE	16	39.4 N	162.9 E	00	30	50	10 NM	02	1002.5	6.1	10.0	14	26			
PRESIDENT POLK	WNEI	16	43.0 N	151.0 E	06	27	45	10 NM	02	1007.0	0.0	1.1	4	8	27	6	6.5
VAN WARRIOR	SMEV	16	52.7 N	171.1 E	06	08	55	< 50 YD	84	0978.5	0.0	1.0	3	24.5	07	< 6	29.5
HANJIN PHMANG	D8ON	16	43.9 N	154.0 W	06	24	M 43	1 NM	64	1004.0	9.0	9.0	XX	29.5	26	6	29.5
PRINCE WILLIAM SOUND	WSDX	16	50.0 N	151.8 W	18	32	M 42	10 NM	02	1004.0	4.0	5.5	4	14.5			
BUNGA MELAWIS	9MUT	16	45.5 N	161.9 E	18	30	M 50	2 NM	70	0989.0	- 2.5	25.0	10	13	30	9	13
PRINCE WILLIAM SOUND	WSDX	17	48.6 N	152.2 W	00	28	M 46	10 NM	02	1017.5	5.5	6.1	8	18	27	11	21
PRESIDENT JEFFERSON	WPBE	17	40.6 N	174.9 E	00	28	45	5 NM	15	1002.8	3.9	7.8	14	19.5			
VAN WARRIOR	SMEV	17	49.6 N	160.8 E	12	34	50	50 YD	86	0979.0	0.0	0.0			02		28
BUNGA MELAWIS	9MUT	17	45.6 N	167.5 E	12	26	M 57	.5 NM	88	0979.5	- 1.0	2.0					
BUNGA MELAWIS	9MUT	18	46.1 N	171.4 E	00	26	M 47	2 NM	16	0983.0	1.0	2.0	13	29.5			
MANHATTAN	WJAF	18	50.7 N	129.6 W	00	30	42	10 NM	01	1009.0	8.4	7.8	3	23	27	10	32.5

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir.	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves Period sec.	Sea Waves Height ft.	Swell Waves Dir.	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		MAR.															
STREAM HAWSER	ELUN	18	40.7 N	162.4 E	00	24	N 21	1	NW	02	1008.0	5.0	5.0	7	23	30	>13	34.5
SKAUGRAN	LMUN	18	50.2 N	129.3 W	18	28	26	5	NW	00	1018.5	9.0	10.0	8	23	29	10	32.5
ASIA BRAVERY	ABCM	18	37.8 N	166.4 E	18	30	N 41	5	NW	00	0998.0	6.5	13.0					
ASIA BRAVERY	ABCM	19	37.5 N	168.1 E	00	36	N 52	2	NW	01	1003.5	7.0	13.5	6	8	31	9	14.5
OVERSEAS JUNEAU	WWND	19	38.3 N	124.0 W	00	33	45	10	NW	01	1016.2	15.6	11.7	6	16.5	28	6	13
STREAM HAWSER	ELUN	19	41.9 N	169.6 E	00	30	N 34	1	NW	04	0973.5	4.0	7.0	7	26	31	>13	37.5
KOREAN PRIDE	ELXF	19	36.5 N	142.2 E	00	32	N 25	10	NW	23	1008.0	7.0	14.0	5	16.5	29	>13	32.5
DIANA	DSJV	19	40.5 N	176.6 E	03	25	N 50	2	NW	18	0987.0	7.0	10.0	6	11.5	25	10	23
PRESIDENT CLEVELAND	KGKA	19	42.2 N	172.2 E	06	28	50	2	NW	74	0989.5	3.0	7.2	7	13	28	12	16.5
SIMBA	OWEC	19	41.8 N	176.7 E	06	24	N 70	.5	NW	02	0982.0	7.8	11.0	14	23			
SKAUGRAN	LMUN	19	52.5 N	135.6 W	18	20	22	2	NW	03	1006.5	10.0	8.0	9	24.5	28	11	32.5
SPRUCE	JPSP	20	50.7 N	134.6 W	00	32	N 45	5	NW	50	1004.0	5.5	6.5					
FRIENDSHIP	ELXP	20	51.4 N	142.4 W	00	29	45	5	NW	02	1008.0	7.0	7.0	8	13	29	10	16.5
PUNGA MELAWIS	9MUT	20	50.5 N	171.1 W	06	24	N 42	5	NW	02	0976.5	2.0	3.0	10	28			
PACIFIC ERA	ELUD	20	54.3 N	164.6 W	12	23	41	2	NW	61	0976.3	4.5	4.0					
FLORA ISLAND	JCHI	20	54.1 N	160.3 W	18	18	N 42	10	NW	01	0991.5	5.8	2.5	5	5	22	9	18
PRESIDENT PIERCE	WUBV	20	54.2 N	168.0 W	18	21	55	2	NW	02	0970.2	2.8	1.1	5	26			
PRESIDENT PIERCE	WUBV	21	54.7 N	169.3 W	00	22	55	2	NW	72	0978.0	4.4	1.1	5	29.5	26	8	36
PACIFIC ERA	ELUD	21	54.3 N	167.5 W	00	23	45	1	NW	88	0981.5	7.0	5.0	13	29.5	22	>13	28
CHEVRON WASHINGTON	KFDB	21	43.8 N	127.5 W	00	23	N 43	10	NW	03	1019.0	11.1		4	13	23	6	23
GLACIER BAY	KACF	21	42.4 N	127.1 W	00	31	45	10	NW	03	1020.2	10.0	8.8	3	8	31	11	29.5
PRESIDENT HOOVER	WTST	21	35.0 N	173.9 E	06	23	50	5	NW	82	1011.9	14.4	15.6	7	24.5			
ALEUTIAN DEVELOPER	WIPL	21	54.8 N	162.8 W	12	19	N 43	10	NW	01	0996.6	2.3	0.0	3	6.5	29	6	10
THOMPSON PASS	WSRY	21	40.0 N	126.0 W	18	36	41	10	NW	01	1023.0	12.0	12.8	4	16.5			
PRESIDENT HOOVER	WTST	22	35.0 N	167.9 E	00	21	35	5	NW	15	1011.9	15.6	13.9	5	32.5			
STREAM HAWSER	ELUN	22	43.1 N	167.3 W	00	07	N 45	1	NW	58	0999.7	10.8	8.8			28		49
SPRUCE	JPSP	22	54.1 N	152.9 W	06	20	N 42	10	NW	01	1018.0	3.0	3.0					
MOBIL ARCTIC	KSPY	22	53.2 N	134.0 W	06	23	N 45	5	NW	20	1016.0	6.1	8.9	2	5	23	8	11.5
MAUI	WSLH	22	31.0 N	130.6 W	12	36	45	10	NW	02	1026.0	14.4	18.3	5	8			
AMERICAN AQUARIUS	WYRI	22	39.0 N	180.0 E	12	32	57	5	NW	54	1007.1	8.3	11.0	4	8	28	8	14.5
SEATRAIN YORKTOWN	DSKP	22	38.9 N	178.5 W	12	22	N 48	2	NW	02	1004.8	12.8	10.0					
SIMBA	OWEC	22	48.5 N	153.7 W	18	23	N 44	10	NW	02	1017.0	6.8	4.5	8	18			
EXXON NEW ORLEANS	WNDM	22	52.8 N	135.2 W	18	29	45	5	NW	02	1023.0	8.7	7.3	4	6.5	29	8	16.5
MARUNA MARU	JJMG	22	42.5 N	176.3 W	18	27	N 56	2	NW	02	1002.8	4.5	9.0	4	18	27	7	14.5
SEATRAIN INDEPENDENCE	DSKL	22	33.1 N	144.7 E	22	25	45	2	NW	02	1020.0	18.0	17.0	6	13	25	10	16.5
DIANA	DSJV	22	46.6 N	162.8 W	23	15	N 43	2	NW	21	1004.0	10.0	7.0	5	10	15	10	13
ENNA G	C2DG	22	37.3 N	124.7 W	23	34	42	5	NW	02	1017.5	13.0	16.0	4	13	34	10	19.5
MARUNA MARU	JJMG	23	42.6 N	173.7 W	00	26	N 44	10	NW	02	1009.5	6.5	10.0	4	18	27	7	16.5
EXXON PHILADELPHIA	WNFJ	23	39.3 N	124.3 W	00	33	N 50	10	NW	02	1017.3	12.5	12.5	5	8	33	8	19.5
SEATRAIN INDEPENDENCE	DSKL	23	33.3 N	143.6 E	02	27	45	5	NW	02	1020.4	19.0	16.8	6	14.5	27	10	16.5
SEA BELLS	9VGM	23	47.5 N	163.9 W	06	14	N 58	200	YD	35	0992.0	7.0	5.0	8	18	14	8	18
NEPTUNE DIAMOND	9VYT	23	40.1 N	124.5 W	12	34	N 42	10	NW	02	1020.0	10.5						
PRESIDENT HOOVER	WTST	23	34.9 N	155.6 E	12	25	50	10	NW	03	1003.4	16.2	14.4	5	32.5			
HANJIN PHNANG	D8ON	23	36.5 N	157.8 E	12	29	N 41	1	NW		0998.0	9.0	16.0	5	23	28	9	26
JADE BOUNTY	ZFCB	23	37.4 N	124.1 W	18	34	35	10	NW	07	1021.0	12.9	20.0	2	10	35	< 6	36
EASTERN FRIENDSHIP	H8LR	23	53.8 N	177.2 W	18	09	N 47	5	NW	83	0975.5	8.0						
SPRUCE	JPSP	23	54.2 N	167.2 W	18	01	N 55	1	NW	04	0993.5	1.7	3.5					
HONSING ARROW	3ENE	23	43.1 N	176.2 E	21	18	N 50	200	YD	81	0983.5	8.0	8.0			18	6	26
DIANA	DSJV	23	47.5 N	157.5 W	23	27	N 45	2	NW	10	1012.0	4.0	6.5	8	16.5	27	>13	23
HONSING ARROW	3ENE	24	43.2 N	176.8 E	00	28	N 60	200	YD	87	0980.5	6.0	7.0			28	6	26
TRIUMPH	3EZZ	24	42.3 N	177.2 E	00	25	N 58	1	NW	58	0988.5	10.0	1.0	10	16.5	23	8	16.5
JADE BOUNTY	ZFCB	24	36.7 N	126.1 W	00	35	32	10	NW	03	1022.3	14.5	20.0	2	10	34	7	36
SPRUCE	JPSP	24	54.1 N	169.5 W	00	34	N 55	5	NW	81	1002.0	4.5	3.5					
IRIS ISLAND	JPKG	24	41.8 N	170.2 E	00	26	N 51	1	NW	03	0992.0	4.0	8.0	6	6.5	27	9	6.5
EASTERN FRIENDSHIP	H8LR	24	53.6 N	179.5 W	00	02	N 45	50	YD	83	0976.5	1.0						
NORSE PILOT	6DVG	24	24.2 N	120.3 E	00	03	N 42	5	NW	07	1020.8	17.5	23.0	4	18	04	6	28
TENNESSEE	LFEI	24	42.7 N	180.0 E	00	20	N 50	2	NW	02	1012.0	5.0		5	6.5	20	6	14.5
DIANA	DSJV	24	47.5 N	156.5 W	03	26	N 43	5	NW	07	1014.5	7.0	6.0	8	16.5	26	>13	23
ATLANTIC PIONEER	H3WN	24	42.8 N	173.1 W	06	21	N 44	.5	NW	97	1001.7	11.5	7.0	10	8	27	12	13
SKAUGRAN	LMUN	24	54.1 N	178.4 W	18	06	45	.5	NW	22	0974.5	8.0				06		16.5
SKAUGRAN	LMUN	25	54.1 N	179.5 W	00	02	41	.5	NW	22	0981.0	2.0	4.0	18	16.5	08		19.5
TENNESSEE	LFEI	25	43.8 N	172.5 W	00	27	N 42	5	NW	02	1012.0	9.0		10	26			
MATSONIA	KHRC	25	22.4 N	151.7 W	06	09	45	5	NW	01	1019.0	21.1	21.1	6	13	08	8	16.5
RED ARROW	5LTT	25	48.6 N	169.9 W	06	26	N 55	1	NW	02	0994.0	4.0	4.0	20	42			
SPRUCE	JPSP	25	53.1 N	174.3 E	18	31	N 58	10	NW	03	0998.5	0.0	2.0					
RED ARROW	5LTT	26	48.2 N	163.8 W	00	24	N 37	10	NW	01	1011.0	5.0	5.7	17	39			
ORIENTAL TAIO	ABCV	26	34.1 N	141.3 E	00	27	N 50	2	NW	01	0975.0	7.0	6.0	5	13	27	< 6	13
PACIFIC VENTURE	5LKM	26	54.2 N	159.0 W	06	25	N 45	2	NW	26	0987.5	4.0	6.0	7	14.5	26	8	19.5
CRYSTAL STAR	D5TG	26	54.1 N	157.0 W	12	24	N 38	2	NW	02	0993.0	3.0	2.5	5	16.5	24	10	32.5
VIENNA WOODS	5LOT	26	54.0 N	156.1 W	17	24	35	2	NW	01	0996.0	5.0	2.0	10	32.5	24		32.5
ATLANTIC PIONEER	H3WN	26	45.7 N	151.3 W	18	21	N 43	.5	NW	44	1004.0	10.5	6.0	10	8	24	>13	13
PRINCE WILLIAM SOUND	WSDX	27	44.1 N	153.4 W	00	28	N 50	5	NW	02	1005.0	9.0	9.5			29	11	19.5
ATLANTIC PIONEER	H3WN	27	46.3 N	146.8 W	06	25	N 45	1	NW	15	1007.0	7.8	6.0	10	6.5	25	>13	11.5
ASIA BRAVERY	ABCM	27	48.7 N	135.8 W	12	20	N 57	.5	NW	59	1010.0	8.0	7.0					
RIGOLETTO	SFMN	28	52.9 N	181.4 W	00	25	N 45	5	NW	23	1002.5	7.0	4.0	6	10	25	>13	26
PRESIDENT TRUMAN	WLRL	28	36.3 N	173.9 E	00	27	46	5	NW	62	1001.7	15.8	15.8	5	10	24	8	16.5
SEALAND COMMERCE	WEUJ	28	38.4 N	167.5 E	12	29	45	5	NW	03	1007.5	7.2	11.2	5	19.5	29	11	24.5
ORIENTAL STATESMAN	ELRE	28	46.4 N	166.7 E	12	31	N 43	5	NW	00	1004.5	10.0	14.5					
MILENA	LMSA	28	34.4 N	167.4 E	18	30	42	5	NW	81	1013.2	9.0						
BROOKS RANGE	WSRP	28	56.3 N	140.4 W	17	24	40	5	NW	50	1004.0	3.3	4.4	6	16.5	24	9	32.5
NEW GOLDEN PHOENIX	3EYN	28	41.5 N	176.4 E	18	30	N 54	5	NW	03	0984.0	4.0	8.0	12	18	27	12	18
KOREAN LEADER	D7XX	28	48.0 N	178.4 W	18	25	N 50	5	NW	02	0987.0	7.0	11.0	8	6.5	25	>13	8
PRESIDENT MADISON	WCIP	28	50.7 N	150.2 W	18	27	46	5	NW	85	1012.0	4.4	7.8	7	8	27	8	18
EXXON NEW ORLEANS	WNDM	28	53.1 N	134.0 W	18	17	55	5	NW	21	1006.0	6.7	7.2	3	5	27	7	16.5
ASIA BOTAN	ELRY	28	40.6 N	169.1 E	18	32	N 32	5	NW	23	1010.7	6.0	8.0	4	10	30	8	32.5
HANJIN INCHEON	D8OC	28	48.3 N	167.3 W	23	16	N 37	2	NW	58	0977.7	7.0	5.0	6	10	15	9	32.5
NEW GOLDEN PHOENIX	3EYN	29	41.4 N	178.9 E	00	30	N 52	5	NW	04	0992.5	3.0	9.0	12	34.5	10	11	34.5
EASTERN FRIENDSHIP	H8LR	29	49.7 N	151.3 E	00	30	N 45	.5	NW	10	1012.5	1.0						
OCEAN LOG	9JLF	29	41.1 N	175.9 W	06	30	N 47	5	NW	02	0996.0	4.7	1.0	5	23	28	6	23
NEPTUNE DIAMOND	9VYT	29	53.7 N	160.0 W	12	13	N 50	.25	NW	02	0978.5	2.5						
VAN CONQUEROR	A8IB	29	46.1 N	177.2 W	12	29	N 45	2	NW	83	0998.0	2.0	4.0					
TOYOTA MARU 12	JBJO	29	38.0 N	168.1 W	12	25	N 41	5	NW	01	1010.4	10.0	12.0	8	16.5	26	10	21
MIEI MARU	JDOC	29	52.3 N	154.2 W	12	12	N 49	2	NW	03	0998.0	4.0	3.0	4	6.5	14	8	13
KOREAN LEADER	D7XX	29	40.4 N	169.0 W	18	26	N 55	5	NW	02	1009.0	5.5	10.8	10	16.5	26	9	26

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10s	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves? Period sec.	Sea Waves? Height ft.	Swell Waves Dir. 10s	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		MAR.															
SEATRAIN CHESAPEAKE	DSOC	29	35.0 N	175.5 E	23	23	N 44	5 NM	03	1014.0	14.0	13.0	10	23	00		0
VIENNA WOODS	SLOT	29	52.9 N	177.8 E	23	34	42	2 NM	26	0992.0	- 1.0	1.0	12	18	34	12	24.5
RIGOLETTO	SFMN	30	52.7 N	160.7 W	00	15	N 45	5 NM	03	0972.5	6.8	2.5	6	8	18	12	23
SEALAND COMMERCE	WCUJ	30	34.7 N	148.6 E	06	17	45	1 NM	63	1008.5	15.6	14.0	8	14.5	18	11	16.5
GENEVIEVE LYKES	WZJA	30	34.1 N	139.8 E	06	27	56	10 NM	00	1000.9	16.2	17.4	5	13	27	6	10
PHILADELPHIA	WJGD	30	55.0 N	137.6 W	12	16	60	5 NM	02	1011.5	3.9	7.2	4	19.5	16	< 6	28
PACIFIC VENTURE	HOVS	30	53.2 N	163.9 W	12	23	N 42	5 NM	18	0983.0	3.0	3.0	10	19.5	23	12	19.5
SILVER STAR	JKIQ	30	54.2 N	156.8 W	18	24	N 45	5 NM	02	0998.0	7.2	4.8	7	8	24	7	24.5
MOBIL ARCTIC	KSPY	30	36.5 N	123.0 W	18	34	N 45	5 NM	07	1022.3	10.5	10.8	3	8	34	7	14.5
HANJIN INCHEON	D8OC	30	48.2 N	174.8 E	23	31	N 30	5 NM	02	1017.0	4.0	4.0	5	8	32	10	32.5
MAUNALEI	KSVE	31	37.4 N	123.6 W	00	33	50	5 NM	07	1019.5	10.0	13.3	15	24.5	35	>13	29.5
CHEVRON OREGON	WNNL	31	39.1 N	124.3 W	00	34	45	10 NM	02	1023.5	10.6		5	16.5			
SILVER STAR	JKIQ	31	54.1 N	160.0 W	06	24	N 45	.5 NM	02	0998.0	12.5	4.5	7	11.5	23	7	24.5
PRESIDENT JEFFERSON	WPGE	31	45.2 N	154.? E	12	29	60	5 NM	15	1011.0	- 3.3	- 0.6	12	39			
PAN PACIFIC	D7SD	31	44.8 N	162.1 E	18	27	42	.25 NM	47	1006.5	0.0	1.0					
EASTERN ROYAL	JMZR	31	46.7 N	164.7 E	18	26	N 45	5 NM	02	0998.0	0.0	1.0	7	19.5	27	9	24.5
VIENNA WOODS	SLOT	31	49.9 N	163.0 E	23	27	45	.5 NM	26	0987.0	1.0	0.0	14	24.5	27	>13	29.5
ENVIRONMENTAL BUOYS																	
46001		30	56.0 N	148.0 W	01	14	N 41			1000.6	2.4	4.1	8	18			
46005		12	46.0 N	131.0 W	23	25	N 41			994.6	7.5	9.0					
46005		13	46.0 N	131.0 W	02	27	N 46			997.2	7.3	8.9	9	21			
		APR.															
PACIFIC VENTURE	SLNN	1	48.4 N	160.9 E	00	32	N 44	2 NM	18	0999.0	- 1.0	3.0	7	16.5	30	9	21
JAPAN CAOBO	SMKV	1	35.0 N	141.5 E	00	22	45	2 NM	51	1005.0	19.0	17.0	12	13	22	12	19.5
GOLDEN ROD	SMZC	1	47.2 N	158.9 E	00	28	N 50	10 NM	03	1008.5	- 2.0	0.0	7	21			
PAN PACIFIC	D7SD	1	45.2 N	165.1 E	00	27	42	.25 NM	47	1006.5	0.0	1.0					
HANJIN INCHEON	D8OC	1	44.3 N	168.7 E	00	27	N 35	2 NM	02	1010.0	2.5	3.0	7	11.5	27	10	36
PRESIDENT TYLER	WEZN	1	44.2 N	173.2 W	00	21	47	5 NM	02	1006.9	6.1	5.6	7	19.5	23	9	11.5
VIENNA WOODS	SLOT	1	49.6 N	162.4 E	05	29	50	2 NM	07	0997.0	0.0	0.0	13	28	29	>13	29.5
NEPTUNE DIAMOND	9VYT	1	49.9 N	164.1 E	06	28	N 44	.25 NM	59	0993.0	0.0	2.5	4	1.5	28	8	13
KEYSTONE CANYON	KSFK	1	41.3 N	126.5 W	06	36	43	> 25 NM	02	1025.0	8.8	8.8	10	8	36	11	13
ALEUTIAN DEVELOPER	WIPL	1	58.8 N	149.9 W	12	16	N 48	5 NM	02	1000.7	5.0	5.0	4	8	14	9	23
CRYSTAL STAR	DSTG	1	48.0 N	159.5 E	12	28	N 30	2 NM	02	1012.0	- 1.0	0.0	4	16.5	28	< 6	32.5
EASTERN RIVER	D5ES	1	39.3 N	177.3 W	12	25	N 45	5 NM	02	1018.0	11.0	10.0	4	6.5	25	10	8
EASTERN ROYAL	JMZR	1	47.2 N	173.4 E	18	27	N 46	5 NM	02	1003.0	2.0	2.5	11	21	27	12	24.5
EASTERN RIVER	D5ES	4	41.6 N	158.5 W	00	29	N 45	2 NM	02	1006.0	13.0	8.0	5	10	31	6	13
NEPTUNE CRYSTAL	9VNW	4	46.2 N	178.8 E	06	28	N 47	5 NM	26	1014.0	1.5	3.1	5	10	28	6	6.5
BLUE OCEAN	JKOH	4	52.4 N	175.1 W	18	27	N 42	5 NM	03	0990.5	2.0	3.0	6	10	27	6	10
BLUE OCEAN	JKOH	5	52.4 N	176.3 W	00	27	N 42	10 NM	01	0991.5	2.0	3.0	6	10	27	6	10
BUNGA MELAWIS	9MUT	5	51.6 N	174.3 E	12	26	N 43	2 NM	02	0993.0	1.0	3.0					
JAPAN ACE	JKFS	5	43.3 N	131.2 W	18	27	N 50	5 NM	02	1000.0	10.0	11.5	XX	13.5	27		26
JAPAN ACE	JKFS	6	44.2 N	132.8 W	00	25	N 44	10 NM	26	0999.0	8.5	10.0	XX	13	28		26
SILVER STAR	JKIQ	6	48.8 N	154.5 E	00	29	N 45	10 NM	02	1000.2	6.0	2.0	5	6.5	29	< 6	6.5
MARITIME QUEEN	HOMC	6	45.3 N	165.0 W	06	27	45	1 NM	23	1005.0	4.0	6.0	10	19.5	27	>13	19.5
SOUTH EXPRESS	A8WR	6	35.4 N	144.3 E	12	22	N 42	2 NM	02	1012.0	18.0	20.0					
MANHATTAN	WJAF	6	50.2 N	128.8 W	18	21	45	10 NM	80	0998.3	6.2	8.8	4	23	22	6	29.5
SIENA	OXFU	6	46.6 N	179.3 E	18	18	N 44	5 NM	02	0988.5	2.0	7.5	8	24.5			
ATROPOS ISLAND	JPMT	6	49.8 N	134.1 W	21	24	55	5 NM	01	1003.1	8.0	7.0	5	6.5	26	13	26
ATROPOS ISLAND	JPMT	7	50.0 N	135.1 W	00	27	50	10 NM	01	1006.0	7.5	7.0	5	6.5	26	13	26
MARITIME QUEEN	HOMC	7	45.3 N	168.0 W	00	24	45	2 NM	64	0982.0	6.5	6.0	12	19.5	25	11	23
TOYOTA MARU 10	JKBI	7	43.1 N	177.5 W	00	29	N 44	1 NM	16	0996.0	8.0	8.0	6	10	28	9	19.5
SOUTH EXPRESS	A8WR	7	35.9 N	147.5 E	00	21	N 49	1 NM	45	1010.0	16.5	19.0	6	19.5	21	7	19.5
SEATRAIN LEXINGTON	DHFC	7	40.3 N	177.0 W	00	24	44	5 NM	50	1001.4	9.8	9.0	4	8	26	7	14.5
PACIFIC ARROW	JGFM	7	42.9 N	162.0 W	12	27	N 52	2 NM	15	0987.0	7.0	7.1	3	6.5	26	10	23
TOKYO RAINBOW	JPGP	7	40.4 N	159.5 W	12	23	N 55	5 NM	58	0998.0	10.0	10.0	5	8	25	6	10
FORTUNSTAR	5LUW	7	46.0 N	157.0 W	17	15	N 52	2 NM	80	0997.1	3.0	6.0	14	39	15	13	32.5
EASTERN RIVER	D5ES	7	46.8 N	130.0 W	18	16	N 55	2 NM	02	1010.0	9.0	7.5	6	10	16	10	10
FRIENDSHIP	ELXP	7	51.0 N	155.9 W	18	11	N 42	1 NM	80	0976.0	3.0	5.5		8	11	11	11.5
ARCO FAIRBANKS	WGWB	7	46.1 N	131.0 W	18	13	N 49	1 NM	61	1006.6	6.7	8.3	3	5	13	8	14.5
PACIFIC ARROW	JGFM	8	41.7 N	157.1 W	00	29	N 48	1 NM	80	0996.0	7.0	8.7	4	6.5	27	8	18
FORTUNSTAR	5LUW	8	46.0 N	153.0 W	05	25	N 58	1 NM	80	0997.7	2.5	6.0	12	42.5	25	13	42.5
ACE ENTERPRISE	JBMT	8	44.6 N	170.2 E	12	27	N 48	.25 NM	05	1000.5	- 2.0	3.0					
BLUE OCEAN	JKOH	8	47.1 N	162.9 E	12	27	N 48	2 NM	02	1005.5	0.5	0.5	5	11.5	27	< 6	11.5
ATROPOS ISLAND	JPMT	8	53.2 N	145.1 W	18	10	45	5 NM	02	0998.0	5.3	5.0	5	6.5	19	13	19.5
MARITIME QUEEN	HOMC	8	43.2 N	176.4 W	18	29	45	5 NM	08	1002.0	6.5	9.0	10	16.5	29	10	23
TONCI TOPIC	ELKX	8	46.3 N	172.9 E	18	27	49	.5 NM	26	0988.3	5.0	2.0	11	16.5			
TONCI TOPIC	ELKX	9	46.7 N	175.2 E	00	27	50	.5 NM	42	0995.0	7.0	2.0	10	16.5			
AUSTRAL ENVOY	WPGK	9	15.2 N	143.8 W	00	09	N 45	2 NM	63	1009.0	24.4	28.3	6	3	09	8	6.5
ACE ENTERPRISE	JBMT	9	45.0 N	174.7 E	00	27	N 49	1 NM	05	1000.5	0.0	2.0	5	5	29	10	9
MARITIME QUEEN	HOMC	9	43.0 N	178.0 W	06	29	56	5 NM	01	1002.0	6.0	8.0			29	>13	26
PACIFIC VENTURE	HOVS	9	38.2 N	159.3 E	18	18	N 44	5 NM	80	1017.2	15.0	13.0	12	23	18	12	23
KEYSTONE CANYON	KSFK	9	47.6 N	130.7 W	18	25	48	10 NM	02	1002.0	7.8	5.6	7	23	25	7	23
KEYSTONE CANYON	KSFK	10	47.3 N	129.1 W	00	25	50	10 NM	02	1001.4	7.8	5.6	5	24.5	25	7	24.5
MARITIME QUEEN	HOMC	10	42.2 N	179.9 E	00	29	55	5 NM	00	1026.0	6.5	9.0			29	>13	28
SILVER STAR	JKIQ	10	36.1 N	148.3 E	06	32	N 60	200 YD	10	0998.8	16.0	18.0	12	26	32	8	26
SWAUGRAN	LHUK	10	32.6 N	142.6 E	06	01	42	5 NM	25	1014.5	14.5	20.0	12	23			
TONCI TOPIC	ELKX	10	47.6 N	176.8 W	06	32	47	5 NM	03	1014.8	4.8	4.0	10	14.5			
ACE ENTERPRISE	JBMT	10	46.1 N	172.9 W	12	31	N 48	1 NM	04	1016.7	0.0	4.0					
STAR DOVER	LEQY	10	50.7 N	163.4 E	18	22	50	2 NM	20	0979.0	1.0						
SEAWAY EXPRESS	DDFO	10	46.7 N	159.2 E	18	28	41	.5 NM	72	1001.2	- 7.0	1.5	6	16.5	27	11	21
SEATRAIN VALLEY FORGE	9VPV	10	31.3 N	151.1 E	18	02	N 48	5 NM	02	1016.0	18.0	19.0					
SEAWAY EXPRESS	DDFO	11	46.1 N	157.2 E	00	29	41	5 NM	26	1004.8	- 0.5	2.0					
SINCERE NO 3	ELRT	11	47.4 N	158.1 E	00	28	N 49	200 YD	02	1000.5	- 4.0	2.0	5	34.5	28	>13	36
STAR DOVER	LEQY	11	50.5 N	162.3 E	00	25	55	5 NM	20	0981.0	0.0						
SIENA	OXFU	11	50.1 N	135.4 W	12	15	N 44	2 NM	63	1008.0	8.2	7.5					
ASIA BEAUTY	A8FW	11	48.6 N	163.5 E	12	27	N 50	1 NM	02	0996.0	1.0	1.0					
ARCTIC TOKYO	5LJY	11	51.9 N	164.5 E	12	27	N 50	5 NM	12	0982.0	0.0	0.0	4	11.5			
OGDEN THAMES	6ZDA	11	52.8 N	136.0 W	18	17	N 48	2 NM	63	1004.0	8.0	7.0	8	29.5	XX	11	31
ASIA BEAUTY	A8FW	12	48.0 N	162.9 E	00	27	N 50	1 NM	72	1003.0	1.0	1.0			27	9	29.5
SINCERE NO 3	ELRT	12	44.4 N	161.0 E	00	27	N 32	5 NM	02	1019.0	- 1.0	2.0	3	26	27	>13	36
STAR DOVER	LEQY	12	49.2 N	160.7 E	00	27	55	5 NM	70	1000.0	- 3.0						
MANHATTAN	WJAF	12	53.3 N	133.6 W	00	14	47	5 NM	63	1011.0	10.0	7.7	8	26	14	8	26

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind			Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves*			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°		Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH PACIFIC OCEAN		APR.																	
GREAT OCEAN	JMJT	12	46.3 N	175.9 E	00	27	M	42	> 25 NM	26	1011.8	3.8	4.8	12	18	27	12	18	
ARCTIC TOKYO	SLJT	12	48.5 N	162.1 E	12	34	M	45	5 NM	12	1009.8	- 2.8	5.1	4	10				
MARITIME QUEEN	NOMC	12	41.8 N	166.2 E	18	25		45	1 NM	06	1015.0	6.5	7.0	12	19.5	25	12	28	
ATROPOS ISLAND	JPMT	13	50.2 N	174.5 W	00	23		45	> 25 NM	02	1007.5	4.0	3.0	7	10	27	10	16.5	
GREAT OCEAN	JMJT	13	48.8 N	172.8 W	09	17	M	44	5 NM	02	1013.0	4.0	5.0	10	4.5	28	10	8.5	
PRINCE WILLIAM SOUND	WSDX	14	43.1 N	126.8 W	12	16	M	44	5 NM	03	1003.0	10.6	10.4	9	8	14	8	11.5	
MANHATTAN	WJAF	16	37.1 N	142.9 W	00	15		45	> 25 NM	01	0993.0	6.7	6.7	8	26				
PACIFIC VENTURE	WGVS	16	40.5 N	136.8 W	06	19	M	41	2 NM	62	1009.7	12.0	12.0	11	21	18	11	21	
PAN PACIFIC	D7SD	16	51.9 N	134.1 W	06	21	M	45	50 YD	97	1009.0	14.0	9.2						
SEALAND FINANCE	WJKG	16	37.9 N	167.9 W	12	27		45	2 NM	00	1014.0	12.2	10.8	5	10	29	6	14.5	
PAN PACIFIC	D7SD	17	53.7 N	139.5 W	00	25	M	43	200 YD	97	1002.6	8.0	14.0						
GREAT OCEAN	JMJT	17	46.5 N	136.4 W	15	14	M	43	5 NM	50	1000.4	9.0	8.0	10	6.5	15	10	5	
MANHATTAN	WJAF	17	50.7 N	135.9 W	18	15		45	10 NM	62	0999.7	7.8	7.2	6	13	20	10	21	
MANHATTAN	WJAF	18	50.0 N	135.1 W	00	15		50	2 NM	02	0995.0	7.8	6.7	5	32.5				
ARCO ANCHORAGE	WCTO	18	50.9 N	135.2 W	00	18		48	2 NM	63	0993.5	4.5	4.5	2	11.5	28	6	19.5	
PACMERCHANT	SMCB	18	41.4 N	157.1 W	00	30	M	41	5 NM	03	1008.5	10.0	14.0	5	6.5	29	9	10	
CRYSTAL STAR	DSTG	18	43.9 N	161.8 E	06	09	M	40	2 NM	27	1002.0	5.8	4.8	5	13	09	9	32.5	
FRIENDSHIP	ELXP	18	51.9 N	172.9 W	06	29	M	45	5 NM	02	1003.0	2.8	6.8	6	11.5	29	7	11.5	
SOVEREIGN VENTURE	ELDQ	18	42.8 N	160.1 E	23	33	M	42	5 NM	00	1000.4	3.5	7.0	3	6.5	06	8	13	
PAN PACIFIC	D7SD	19	54.5 N	158.0 W	00	30	M	45	10 NM	01	0998.0	9.0	3.0	7	13	30	7	13	
PACMERCHANT	SMCB	19	41.0 N	147.6 W	06	29	M	41	5 NM	23	1012.0	7.5	12.0	4	6.5	29	9	11.5	
SEALAND FINANCE	WJKG	19	37.6 N	159.5 E	06	31		45	10 NM	02	1020.0	7.9	10.4	9	16.5	29	12	24.5	
CRYSTAL STAR	DSTG	19	46.2 N	169.4 E	12	33	M	40	2 NM	02	1002.0	3.8	2.0	5	13	33	9	32.5	
ATLANTIC PIONEER	H3WN	19	38.6 N	144.2 E	18	20	M	51	10 NM	05	1018.5	13.0	13.0	5	10	30	7	14.5	
CRYSTAL STAR	DSTG	20	46.2 N	176.4 E	12	29	M	33	5 NM	02	1004.0	4.0	2.0	5	13	29	6	32.5	
CHALMETTE	SMMG	20	35.6 N	142.2 E	18	21		45	5 NM	07	1009.4	19.5	15.9	5	16.5	29	7	13	
OGDEN THAMES	6ZDA	21	43.2 N	149.2 E	00	25	M	42	2 NM	58	1006.0	4.0	2.0	6	23	XX	11	23	
HANJIN INCHEON	D8OC	22	49.7 N	177.0 W	23	14	M	33	2 NM	62	0997.0	4.0	3.0	6	18	16	9	32.5	
SINALOA	GXNS	23	47.6 N	170.7 W	18	26	M	45	5 NM	02	0997.0	5.5	10.2	9	23				
HANJIN INCHEON	D8OC	23	51.5 N	186.5 W	22	04	M	40	2 NM	48	0984.1	4.0	3.0	6	10	05	8	32.5	
SINALOA	GXNS	24	47.7 N	168.6 W	00	28	M	51	5 NM	02	0997.0	6.4	10.3	8	26				
MARUNA MARU	JJMQ	24	41.8 N	152.0 W	12	26	M	41	5 NM	21	1007.5	8.0	10.0	7	13				
KUROBE MARU	JFIR	24	43.3 N	149.0 W	18	27	M	45	5 NM	02	1000.2	9.5	7.5	5	11.5	27	7	14.5	
ORIENTAL CHAMPION	VRCF	24	46.7 N	153.7 W	18	29		48	2 NM	02	0991.8	4.7	6.8	6	13	27	12	34	
SEATRAIN YORKTOWN	D5NP	24	48.3 N	149.2 W	18	27	M	41	5 NM	02	1011.1	10.5	9.8	8	14.5				
ORIENTAL CHAMPION	VRCF	25	46.6 N	151.2 W	00	29		44	2 NM	28	0994.2	5.0	4.0	8	24.5	29	>13	34.5	
ARCO ALASKA	WSBK	25	52.3 N	136.1 W	00	14	M	42	5 NM	07	0999.1	8.5	5.0	4	16.5	17	< 6	32.5	
SILVER STAR	JKIQ	25	41.9 N	162.8 E	00	29	M	45	5 NM	01	1000.2	16.0	4.0	5	13	29	< 6	13	
AMERICAN ASTRONAUT	WZJG	25	42.8 N	176.5 W	12	22		55	1 NM	21	1006.0	9.4	9.4	6	8	22	< 6	8	
EASTERN ROYAL	JMZR	25	53.7 N	174.9 W	18	09	M	44	1 NM	85	0980.5	1.0	3.5	10	21	09	>13	19.5	
MOBIL ARCTIC	KSPY	25	58.7 N	143.3 W	18	10	M	44	10 NM	60	1001.2	5.8	4.4	5	10	12	10	19.5	
HANJIN INCHEON	D8OC	25	50.5 N	145.4 W	20	32	M	30	5 NM	02	1001.0	6.0	6.0	5	8	34	9	34.5	
PAN PACIFIC	D7SD	26	42.1 N	144.3 E	06	24	M	42	5 NM	02	1011.0	8.0	2.0	0	0	20	< 6	1.5	
OGDEN FRASER	5MPQ	26	46.7 N	175.8 W	06	27	M	45	2 NM	02	0998.0	6.0	5.0	6	11.5	28	10	29.5	
EASTERN HOPE	JJIG	26	54.0 N	176.0 W	12	35	M	42	2 NM	01	0994.0	- 0.5	4.0	5	10	34	6	19.5	
HANJIN INCHEON	D8OC	26	49.5 N	134.8 W	19	19	M	20	5 NM	03	1007.0	10.0	7.0	4	6.5	24	10	32.5	
ORIENTAL EXECUTIVE	D5AN	26	33.7 N	140.2 E	21	31	M	42	5 NM	01	1013.0	16.5		10	14.5				
NORTH STAR III	KPXT	27	52.4 N	172.8 W	00	32	M	48	10 NM	02	1000.3	0.6	4.4	5	10	32	11	21	
MOBIL ARCTIC	KSPY	27	53.9 N	134.9 W	06	16	M	48	5 NM	63	0998.2	6.4	4.4	4	8	17	9	13	
PRESIDENT TYLER	WEZM	27	31.1 N	128.8 E	06	31	M	40	10 NM	01	1001.3	13.9	14.4	7	19.5	16	8	32.5	
AMERICAN ASTRONAUT	WZJG	27	43.8 N	155.2 W	04	27		45	10 NM	02	1006.0	7.2	7.2	6	13	27	6	23	
PRESIDENT GRANT	WEZD	27	42.5 N	174.9 E	18	02	M	48	2 NM	62	0982.1	3.9	5.6	8	24.5	08	10	39	
PRESIDENT GRANT	WEZD	28	42.0 N	176.0 E	00	36	M	55	2 NM	62	0987.1	4.4	5.0	3	13	36	8	41	
VIENNA WOODS	SLOT	28	40.1 N	148.1 E	05	12	M	45	1 NM	29	1007.0	12.0	11.0	12	24.5	12	12	26	
EVER VALUE	H3NH	28	38.1 N	149.0 E	06	13	M	44	2 NM	02	1017.5	13.0	15.0	6	19.5	13	11	19.5	
SEALAND LEADER	WSNH	29	39.5 N	159.0 E	06	16	M	47	2 NM	61	1014.1	11.0	12.0	5	10	14	< 6	16.5	
OGDEN FRASER	5MPQ	30	48.5 N	145.0 W	06	20	M	45	2 NM	03	1009.5	9.0	8.0	6	10	29	8	23	
BLUE OCEAN	JMQH	30	47.3 N	167.6 E	06	11	M	46	.5 NM	66	1007.0	3.0	6.0	9	6.5	11	< 6	6.5	
ENVIRONMENTAL BUOYS																			
46001		1	56.0 N	148.0 W	06	14	M	42			1004.1	4.7	4.1	9	21				
46004		6	51.0 N	136.0 W	18	28	M	43			990.6	4.5	5.8	8	18				
46004		17	51.0 N	136.0 W	21	16	M	41			996.4	6.8	6.1	6	11.5				
46005		7	46.0 N	131.0 W	18	12	M	42			1006.3	6.3	8.6	7	13				
46005		9	46.0 N	131.0 W	04	23	M	41			996.2	6.8	8.3						
46006		13	40.7 N	137.7 W	05	36	M	44			1005.9	7.7	10.6						

* Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

U.S. Cooperative Ship Weather Reports

March and April 1980

This listing includes only those ships recruited in the U.S. Cooperative Ship Program whose Ship's Weather Observations (NOAA Form 72-1) were mailed to the National Climatic Center and/or the coded weather observations were transmitted to the appropriate radio station.

SHIP NAME	VIA RADIO	VIA MAIL
OGDEN THAMES	89	38
ACUSHNET WAGG 167		72
ADRIATIK	14	
ALASKA STANDARD	21	20
ALEUTIAN DEVELOPER	32	44
ALMERIA LYKES	37	117
AMERICA MARU	39	9
AMERICAN ALLIANCE	46	92
AMERICAN ARGOSY	42	66
AMERICAN CHAMPION	8	9
AMERICAN COURIER	57	93
AMERICAN INDEPENDENCE	13	145
AMERICAN LEGACY	45	58
AMERICAN LYNX	28	128
AMERICAN TRADER	63	224
AMOCO MILFORD HAVEN	3	
ANDALUSIA	26	
ANTONIA JOHNSON	7	110
APCO FAIRBANKS	68	129
APCO PRUDHOE BAY	93	135
ARGONAUT	25	22
ARTHUR MAERSK	34	112
ASIA BOTAN	16	96
ASIA HUNTER	1	
ATHEL LADAKI	9	
AUSTRAL ENSIGN	48	18
AUSTRAL MOON	66	131
AUSTRAL RAINBOW	70	117
B T SAN DIEGO	24	144
BARBER PRIAM	36	
BARRANCA	59	39
BAYAMON		69
BEN FRANKLIN	2	
BLUEBIRD	115	33
BOSTON	9	5
BRINTON LYKES	21	67
C W LIGHTNING	23	22
CALIFORNIAN	33	36
CARIBBEAN ENDEAVOUR	1	
CHARLES LYKES	46	72
CHALVERNET T AGS 29		58
CHERRY VALLEY	8	19
CHEVRON ZURNADY	10	103
CHEVRON EDINBURGH	25	138
CHEVRON LONDON		86
CHEVRON PERNIS	27	175
CHINO	1	
COLORADO	23	64
COLUMBUS VICTORIA	69	115
CORNUCOPIA	35	4
COVADONGA	9	63
DAFFODIL	16	
DANA AMERICA	11	
DAVID P REYNOLDS	78	152
DEL ORO		23
DELAWARE II	90	101
DELTA ARGENTINA	25	39
DELTA PAR	22	57
DEPENDABLE AMEC 626		92
DITTE SKOU	21	68
DOLLY TURMAN	14	45
EYWI NATTEGAT	8	
EASTERN CHERRY	23	
EASTERN MUSE	48	
EASTERN WISEMAN	16	
EL PASO CONSOLIDATED	9	
ERNA OLDENDORFF	5	
ESSO PROVIDENCE	17	16
EVELINE	10	
EXPORT AMBASSADOR	6	
EXPORT CHAMPION	15	72
EXPORT PATRIOT	11	
EXXON BOSTON	16	32
EXXON HUNTINGTON	56	74
EXXON NEWARK	14	10
EXXON WASHINGTON	16	18
FESTIVALE	18	30
FRANCIS SINCERE NO 6	56	64
GALLATIN WMEC 721		25
GENEVIEVE LYKES	5	102
GIBRALTAR PANSY	6	
GLOBAL FRONTIER	19	61
GOLDEN BEAR	29	67
GOLDEN FAY	10	
GREAT LAKE	54	61
GREEN FOAM	34	
GULF BANKER	12	62
GULFDEEP	1	
HANDANGER	13	22
HELLESPONT GLORY	17	77
HOEGH MALLARD		21
HOEGH MERIT	17	62
HOEGH PRIDE	12	48
HOWARD O VESPER	5	26
HUDSON T-AG 194	3	76
INGER	12	124
IRONWOOD WLB 297	6	
JADRAN	21	
JAPAN AMBROSE	51	46
JEFF DAVIS	5	
JUTLANDIA	19	96
KENNETH E HILL	8	5
KOPRA	79	121
KOREAN LEADER	8	27
L.A. FUHRMOUSER	10	117
LAKE PALOURDE	1	61
LASH PACIFICO	9	83
LESLIE LYKES	28	
LILLOORT	13	67
LOUISE	50	112
MAGDALENA	93	
MANHATTAN	43	143
MANUKAI	68	144
MAR DE CORTEZ	16	79
MARDI GRAS	22	37
MARIA G	15	43
MARITIME HARMONY	10	
MATHIESON	28	
MAURICIO DE OLIVEIRA	42	18
MAYO LYKES	25	80
MENESTHEUS	53	
MIKE	1	
MINERVA	18	

SHIP NAME	VIA RADIO	VIA MAIL
ACADIA	6	
ADABELLE LYKES	4	
AFRICAN DAWN	17	106
ALASKAN	34	86
ALLISON LYKES	9	
ALSTER EXPRESS	13	81
AMERICA SUN	29	73
AMERICAN APOLLO	29	128
AMERICAN ARROW	17	
AMERICAN CHARGER	3	
AMERICAN EXPLORER	22	98
AMERICAN LANCER	39	127
AMERICAN LEGEND	7	
AMERICAN RACER	24	109
AMERICANA	19	37
ANCHORAGE	42	110
ANDERS MAERSK	28	55
ARCO ALASKA	29	53
ARCO HERITAGE		50
ARCO SAG RIVER	2	33
ARIES		21
ARTHUR MIDDLETON	4	
ASIA BRAVERY	22	96
ASIA INDUSTRY	10	
ATLANTIC PIONEER	11	84
AUSTRAL ENTENTE	49	66
AUSTRAL PATRIOT	10	46
AVILA	9	
BALT BUTTE	15	78
BARBER TAIF	15	28
BARUA	1	51
BAYANO	45	88
BERGLJOT	5	
BOGASARI SATU	3	15
BRAZOS	47	71
BROOKS RANGE	21	39
C V STAGHOUND	19	63
CAMARA	10	60
CARNEVALE	55	77
CHARLES PIGOTT	26	115
CHAVEZ	28	50
CHESNUT HILL	50	121
CHEVRON CALIFORNIA	31	
CHEVRON FELUY	11	148
CHEVRON MISSISSIPPI	26	47
CHEVRON PERTH	28	78
CHRISTOPHER LYKES	18	86
COLUMBUS AMERICA	30	154
CORAL ARCADIA	9	
CORONADO	9	
CRESSIDA	47	124
DALAMAN	37	44
DANWOOD ICE	35	48
DAVID PACKARD		33
DEL AGIO	6	
DELAWARE SUN	32	13
DELTA BRASIL	9	48
DELTA MEXICO	14	53
DIAMOND PHOENIX	41	
DJATISARI	15	36
DORIC	28	57
DYNE PACIFIC	2	1
EASTERN DIAMOND	1	119
EASTERN PACIFIC	19	14
EASTLAND WMEC	25	
EL PASO SOUTHERN	16	21
ESSO CASTELLON	9	17
ESSO PUERTO RICO		7
EVELYN MAERSK	1	
EXPORT BANNER	15	50
EXPORT COURIER		37
EXXON BALTIMORE	2	7
EXXON CHESTER	9	17
EXXON JAMESTOWN	19	36
EXXON NORTH SLOPE	1	9
FAIRLOAD	1	
FFM PATARENGI	1	
FREDERICK LYKES	9	53
GARDENIA	52	52
GEORGE B KELLEZ	35	
GLACIER WARD 4	81	87
GLOMAR KING	10	
GOLDEN DAISY	17	19
GOLDEN ROD	23	45
GREAT OCEAN	25	69
GREEN HARBOUR	6	55
GULF FARMER	19	62
GUNDULIC	1	
HARANGJIN	2	
HERON	49	57
HOEGH MARLIN	9	56
HOEGH OPAL	12	17
HONSING ARROW		4
HOWARD W BELL	6	65
HUMACAO	64	
INGHAM WMEC 35		86
J LOUIS	49	86
JAMES E O'BRIEN	1	89
JAPAN CAOSO	19	135
JELA TOPIC	32	118
K H CRANDALL		12
KEYSTONER	70	113
KOREAN COMMANDER	7	14
KOREAN PRIDE	20	25
LABRADOR CLIPPER	51	
LAKE SHASTA	27	83
LAUREL	1	
LETITIA LYKES	11	96
LIONS GATE BRIDGE	110	118
LOUISE LYKES	19	88
MALLORY LYNX	44	143
MANICA	1	17
MANULANI	76	131
MARCONA CONVEYOR	28	71
MARGARET JOHNSON	7	8
MARIAS TAG-87		72
MARITIME INVESTOR	7	
MATSONIA	49	70
MAYA PIONEER	3	52
MC ARTHUR	2	
MEDNIA	27	78
MILENA	10	33
MING AUTUMN	30	

SHIP NAME	VIA RADIO	VIA MAIL
ACE ENTERPRISE	24	70
ADM WM M CALLAGHAN	51	67
AGUADILLA	79	106
ALBATROSS IV	56	
ALLTRANS ENTERPRISE	1	
ALVA MAERSK	32	94
AMERICAN ACCORD	55	65
AMERICAN AQUARIUS	25	89
AMERICAN ASTRONAUT	39	125
AMERICAN CHIEFTAIN	35	62
AMERICAN HERITAGE	30	21
AMERICAN LARK	35	131
AMERICAN LEGION	9	105
AMERICAN RANGER	25	83
AMOCO CAIRO		69
ANCO STANE	62	
ANNA MAERSK	27	50
ARCO ANCHORAGE	49	80
ARCO JUNEAU	58	81
ARCTIC TOKYO		138
ARILD MAERSK	28	74
ASHLEY LYKES	34	42
ASIA HERON	12	
ASIA MONO	19	
ATLANTIC RAINBOW	25	101
AUSTRAL ENVOY	18	101
AUSTRAL PILOT	29	55
AXEL MAERSK	11	51
BALTIMORE TRADER	52	123
BARBER TOBA	9	12
BASSWOOD WLB388	4	4
BEISHU MARU	86	43
BERNES	61	
BONEME	42	116
BREWSTER	9	18
BUILDER	9	53
CAGUAS		23
CAMPBELL WMEC 32	8	
CHALMETTE	58	101
CHAPLOTTE LYKES	31	
CHEMICAL VENTURE	30	
CHEVRON ANTWERP	1	
CHEVRON COLORADO	76	97
CHEVRON FRANKFURT	14	38
CHEVRON NORTH AMERICA		110
CHEVRON SOUTH AMERICA	1	216
CITRUS WLB300	4	
COLUMBUS AUSTRALIA	15	47
CORANTIJN	21	40
CORVIGLIA	2	
CRISTOBAL	8	106
DALLAS WMEC 716	1	
DAUNTLESS CG	8	
DAVID STARR JORDAN	21	33
DEL SOL	23	2
DELTA AFRICA		69
DELTA CARIBE	22	
DELTA PERU	9	13
DIANA PROSPERITY	19	
DOCEANGRA	1	
DRUCILLA U	10	
E. HORNSBY WASSON	4	59
EASTERN FORTUNE	16	29
EASTERN RIVER	15	72
EDGAR QUEENY	54	51
ELIZABETH LYKES	15	29
ESSO CHITTAGONG	4	
ESSO SAINT JOHN	18	53
EVEP SPRING	32	62
EXPORT BUYER		3
EXPORT FREEDOM	13	87
EXXON BANGOR	15	68
EXXON FLORENCE	4	9
EXXON LEXINGTON	19	83
EXXON PHILADELPHIA	19	70
FALSTRIA	27	87
FLEETBANK	42	
FRIENDSHIP	34	107
GARTHNEWYDD	8	38
GEORGE M KELLER	10	106
GLACIER BAY	27	81
GLOMAR CHALLENGER	86	183
GOLDEN GATE		84
GRACE	2	
GREEN AUKLET	42	
GREEN ISLAND	3	80
GULF SHIPPER	12	45
HAMILTON WMEC 715	6	
HARUNA MARU	109	65
HIKI MARU	105	87
HOEGH MASCOT	1	66
HOEGH ORRIS	13	23
HONSHU GLORIA	21	12
HOWELL LYKES	23	91
IMPERIAL	8	
IRIS ISLAND	32	66
J R GREY		192
JAMES LYKES	11	28
JAPAN RAINBOW	18	58
JOHN LYKES	33	
KASHU MARU	89	44
KOBE STAR	19	77
KOREAN FIR	14	22
KOPPAN	43	
LAKE ALMANOR	15	96
LASH ATLANTICO	21	36
LEDA MAERSK	54	133
LEXA MAERSK	22	
LIPSCOMB LYKES	24	63
LUIGI GRIMALDI	41	65
MALLOW WLB 396	1	
MANISTEE	34	
MANULEI	76	116
MARCONA EXPORTER	16	59
MARGARET LYKES	2	17
MARINE CHEMICAL TRANSP	23	106
MARITIME QUEEN		32
MAUI	92	138
MAYAGUEZ	27	137
MEADOWBROOK	1	57
MERCY	12	
MILLER FREEMAN	126	172
MING CHEER	24	38

SHIP NAME	VIA RADIO	VIA MAIL
ACONCAGUA	4	11
ADRIAN MAERSK	38	99
AIMEE LYKES	18	101
ALBERT MAERSK	13	56
ALLTRANS EXPRESS	34	81
AMELIA TOPIC	4	
AMERICAN ACE	5	84
AMERICAN ARCHER	87	63
AMERICAN CHALLENGER	26	111
AMERICAN CORSAIR	11	84
AMERICAN HIGHWAY	20	
AMERICAN LEADER	32	77
AMERICAN LIBERTY	89	117
AMERICAN RELIANCE	19	54
AMOCO CHALLENGER	14	
ANCO TEMPLAR	48	
ANNIE JOHNSON	4	52
ARCO ENTERPRISE	14	49
ARCO PRESTIGE	6	32
ARECIBO	28	91
ARNOLD MAERSK	30	71
ASIA BEAUTY	31	110
ASIA HONESTY	30	62
ASIAN ASSURANCE	2	68
AUSTRAL ENDURANCE	37	90
AUSTRAL LIGHTNING	52	109
AUSTRAL PIONEER	32	105
AZTECA	19	109
BANNING	23	
BARBER TONSBERG	9	
BAY	13	61
BELLMAN	53	66
BLUE OCEAN	9	125
BORINQUEN	108	115
BRIGHT HOPE	20	36
BUNGA SRIPADI	21	
CALIFORNIA RAINBOW	9	
CAPRICORN	75	
CHANCELLORSVILLE	21	74
CHASTINE MAERSK	5	19
CHEROKEE WMEC 165	1	35
CHEVRON ARIZONA	23	57
CHEVRON COPENHAGEN	9	108
CHEVRON KENTUCKY	84	
CHEVRON OREGON	23	30
CHEVRON WASHINGTON	66	59
CG APOLLO	1	
COLUMBUS LOUISANA	31	64
CORINTO MARU	40	27
COURAGEOUS WMEC 622		65
CRYSTAL REED	14	21
DANA AFRICA	1	
DAVID D. IRWIN	11	17
DEFIANCE	24	104
DELAWARE GETTY	17	41
DELTA AMERICA	8	
DELTA ECUADOR	26	91
DELTA VENEZUELA	21	37
DISCOVERER OSS	78	78
DOCTOR LYKES	31	64
DUBHE	14	
EAGLE	9	
EASTERN JADE	17	
EASTERN TREASURE	34	
EL PASO ARZEW	88	69
ENNA G	52	169
ESSO PALM BEACH		16
EURO-ASIA CONCORDE	36	105
EVER VALUE	3	10
EXPORT CHALLENGER	7	31
EXPORT LEADER	5	16
EXXON BATON ROUGE	41	58
EXXON HOUSTON	24	23
EXXON NEW ORLEANS	31	60
EXXON SAN FRANCISCO	31	51
FEDERICO C	13	
FORTUNSTAR	2	4
GABE LYKES	76	
GENE TREFETHEN	61	
GIBRALTAR MARU	24	19
GLADIOLUS	3	
GOLDEN ARROW	89	42
GOLDEN GATE BRIDGE	107	82
GRAND GLOBE	22	24
GREEN FOREVER	23	
GREEN VALLEY	3	42
GULF TRADER	46	73
HANJIN INCHEON	6	32
HAWAIIAN CITIZEN	114	178
HILLYER BROWN	9	16
HOEGH MERCHANT	1	
HOEGH PILOT	3	40
HOTAKA MARU	118	33
HUAL TRAVELLER	1	
IMACHUS STAR	35	93
IRIS QUEEN	49	
JACKSONVILLE	20	111
JAPAN ACE	92	48
JEAN LYKES	17	
JOSEPH LYKES	15	76
KEITO	25	119
KOFUKU MARU	25	98
KOREAN JUPITER	1	
KUROBE MARU	50	27
LAKE ARROWHEAD	21	
LASH ITALIA	26	49
LEO	16	
LIBRA	8	36
LONG BEACH	1	
LURLINE	66	157
MAMMOTH PIR	48	145
MANUANUI	64	106
MANZANARES	37	69
MARCONA TRANSPORTER	40	120
MARIA RUBICON	21	
MARITIME DOMINION	21	
MARJORIE LYKES	4	48
MAUMEE	2	
MAYAYAN REEFER		8
MELVIN H. BAKER	4	
MIDGETT WMEC 726	16	18
MILROSS	18	
MING HOPE	22	40

TOTAL WEATHER REPORTS RECEIVED FROM US COOPERATIVE OBSERVING SHIPS MARCH AND APRIL 1980

SHIP NAME	VIA RADIO	VIA MAIL	SHIP NAME	VIA RADIO	VIA MAIL	SHIP NAME	VIA RADIO	VIA MAIL	SHIP NAME	VIA RADIO	VIA MAIL
MING SPRING	34	58	MING YOUNG	44	56	MOBIL AERO	15	162	MOBIL ARCTIC	53	121
MOBIL LUBE	56	113	MOBIL POWER	6	35	MOBILE MERIDIAN	36	37	MOBILFUEL	48	101
MOBILBAS	6	11	MOBILOIL	18	23	MONMOUTH	34	46	MONTEREY	8	
MONTIRON	36		MONTPELIER VICTORY		4	MORMACALTAIR	17	59	MORMACARGO	25	76
MORMACDRACO	38	71	MORMACGLEN	18		MORMACLYNX	34	81	MORMACRIGEL	12	19
MORMACSAGA	18	55	MORMACSEA	4		MORMACSKY	7	45	MORMACSTAR	31	44
MORMACSUN	17	30	MORMACTIDE	16	20	MORMACVEGA	7	39	MORMACWAVE	30	41
MORNING GLORY	44	89	MOZART FESTIVAL	8		MT MITCHELL	81	164	NAGARA	1	
NANCY LYKES	20		NECHES	9	19	NEPTUNE CRYSTAL	64	93	NEPTUNE RUBY	44	
NEW GOLDEN PHOENIX	58	52	NEW JERSEY MARU	72	20	NEWARK	90	37	NEWCASTLE CLIPPER	32	
NOORWAY	45	63	NOPAL LAKE	18		NOPAL VERDE	2	112	NORDHEIDE	31	
NORDIC CHIEFTAIN	2		NORDIC LOUISIANA	48		NORDIC PRINCE	6		NORSE PILOT	59	83
NORTH STAR III	10	16	NORTHWIND WAGB 282	70	148	OCEAN CROWN	11		OCEAN DUKE	11	
OCEAN LOG	35	46	OCEANIC	117	167	OCEANOGRAPHER	135	143	OGDEN CONGO	7	12
OGDEN FRASER	20	42	OGDEN WILLAMETTE	1		OJI GLORIA	40		OLEANDER	72	88
OLGA TOPIC	34	62	ORANGE	68		OREO TRADER	1	54	ORE JUPITER	21	
ORE MERIDIAN	49	144	ORIENTAL COMMANDER	14	52	ORIENTAL EDUCATOR	1		ORIENTAL ESEARCHER	6	9
ORIENTAL EXECUTIVE	25	114	ORIENTAL LEADER	13		ORIENTAL SOVEREIGN	32	35	ORIENTAL STATESMAN	29	60
OTTO N. MILLER	46	202	OVERSEA FRUIT	1		OVERSEAS ALEUTIAN	2	7	OVERSEAS ARCTIC	26	73
OVERSEAS CHICAGO	1		OVERSEAS JUNEAU	90	108	OVERSEAS NEW YORK	1	6	OVERSEAS OHIO	38	
OVERSEAS VALDEZ	5	21	PACBARON	14	24	PACBARONESS	19		PACDUCHESS	14	19
PACDUKE	5		PACEMPEROR	14		PACGLORY	17	29	PACIFIC ACE	1	34
PACIFIC ARROW	117	60	PACIFIC CARRIER	1		PACIFIC ERA	32	64	PACIFIC PEACE	11	89
PACIFIC SAGA	67	105	PACIFIC VENTURE	71	316	PACIFIC WING	2		PACKING	1	3
PACPAJESTY	8	16	PACPERCHANT	11	36	PACPHOARCH	9		PACPRINCE	14	
PACPRINCESS	11		PACSTAR	3		PAN ASIA	5	14	PAN PACIFIC	34	84
PAN WESTERN	17	25	PARALLA	25	56	PERENNIAL ACE	82		PERRYVILLE	11	58
PERSIAN REEFER	37	78	PHILADELPHIA	60	94	PINE LIGHT	1		PIONEER COMMANDER	18	21
PIONEER CONTENDER	23	93	PIONEER CONTRACTOR	18		PIONEER CRUSADER	1		PIONEER MOOM	82	136
POLAR ALASKA		32	POLAR SEA	96	112	POLAR STAR WAGB-10	164		PORTLAND	62	98
PRESIDENT ADAMS	31		PRESIDENT CLEVELAND	24	59	PRESIDENT FILLMORE	33	66	PRESIDENT GRANT	45	109
PRESIDENT HARRISON	27	82	PRESIDENT HOOVER	82	142	PRESIDENT JACKSON	4	8	PRESIDENT JEFFERSON	98	137
PRESIDENT JOHNSON	68	161	PRESIDENT KENNEDY	44	75	PRESIDENT MADISON	73	130	PRESIDENT MC KINLEY	53	117
PRESIDENT PIERCE	63	131	PRESIDENT POLK	29	53	PRESIDENT TAFT	71	154	PRESIDENT TAYLOR	15	32
PRESIDENT TRUMAN	61	110	PRESIDENT TYLER	73	131	PRESIDENT VAN BUREN	65	154	PRESIDENT WILSON	9	
PRINCE OF TOKYO	23		PRINCE WILLIAM SOUND	30	116	PROSPERITY	7		PROSPERITY QUEEN	8	14
PURE OIL	7	64	PVT JOHN R TOWLE	4	31	PVT LEONARD C BROSTROM	44		QUEENS WAY BRIDGE	104	94
QUEENSLAND	1		QUINTINA	32		QUIXADA	18	2	R G FOLLIS	9	46
RADIANT STAR	11		RAINIER	8	7	RALPH G JOHNSON	20	61	RED ARROW	18	19
REGINA CELI	1		RELIANCE WMEC 615	2		RESEARCHER	93	139	RESOLUTE	32	45
RESOLUTE WPC 620	54	30	RHEINFELS	3		RICHARD	34	44	RIGOLETTO	26	34
RIO MACAREO	1		RIO OLIVIA	51	23	ROBERT E LEE	4		ROBERT TOOMBS	2	
ROBERTSBANK	19	81	RODRIGUES CABRILHO	44	51	ROSE	2	129	ROSE CITY	3	22
ROYAL VIKING SKY	94	109	ROYAL VIKING STAR	24	35	RUSH WMEC 723		7	RUTH LYKES	15	64
SACRAMENTO	1	69	SALVADOR	33	67	SAM HOUSTON	5		SAN ANTALANGIE	3	
SAMOA	46	93	SAMUEL S	5		SAN FRANCISCO	9	56	SAN JUAN	8	9
SAN MARCOS	17	25	SANKOGRAIN	2		SANKOSTAR	16		SANKOSUN	13	
SANSINENA II	31	76	SANTA BARBARA	19	73	SANTA MAGDALENA	42	89	SANTA MARIA	38	109
SANTA MARIANA	49	94	SANTA MERCEDES	31	68	SARDONA	12		SARGODHA	34	93
SEA FAN	16	16	SEALAND ADVENTURER	8	4	SEALAND COMMERCE	60	108	SEALAND CONSUMER	39	84
SEALAND ECONOMY	46	105	SEALAND EXCHANGE	58	78	SEALAND FINANCE	20	78	SEALAND GALLOWAY	48	65
SEALAND LEADER	21	60	SEALAND MARKET	25	76	SEALAND MCLEAN	27	101	SEALAND PRODUCER	35	111
SEALAND RESOURCE	63	104	SEALAND TRADE	43	120	SEALAND VENTURE	44	119	SEASPEED ASIA	5	
SEATRAIN INDEPENDENCE	78	115	SEATRAIN LEXINGTON	95	183	SEATRAIN ORISKANY	38	147	SEATRAIN PRINCETON	72	155
SEATRAIN TRENTON	102		SEATRAIN VALLEY FORGE	2		SEATRAIN YORKTOWN	45	159	SEAWAY	22	156
SEAWAY DISPATCH	10		SEDGE WLB 402	4		SERAFIN TOPIC	10	83	SHANGRI LA	63	134
SHELDON LYKES	9		SHENANDOAH	1		SHEPMAN WMEC 720	4	143	SHING ON	1	
SHIRLEY LYKES	10	34	SHUNLIND	60	112	SILVANA LOLLI GHETTI		46	SILVER LADY	37	18
SILVER PHOENIX	48	36	SILVERLIME		119	SINALOA	35	105	SINCERE NO 3	26	49
SINCERE NO 5	48		SINCLAIR TEXAS	11	79	SKAUGRAN	64	130	SKYWARD	23	
SNOW CRYSTAL	23	51	SNOW STORM	23	142	SONIO INTREPID	1		SOLON TURMAN	19	63
SOUTHWARD	26	62	SOUTHWEST CAPE	34		SPERO	5		SPRINGBANK	3	
SPRUCE	18	101	STADT BREMEN	8		STAR DIEPPE	5		STAR DOVER	39	129
STAR HONGKONG	4	7	STARGARD	34	46	STATE OF TRIPURA	44	79	STEADFAST WMEC 623	1	
STELLA LYKES	27	34	STOLT LANGAFF	21		STONEWALL JACKSON	17	46	STOVE TRADER	44	127
STREAM HAWSER	10	11	STUYVESANT	59	126	SUCCESSFUL VENTURE	21	16	SUGAR ISLANDER		45
SUNNY STATE	1		SURVEYOR	60	126	SUSQUEHANNA	16	91	SVENDBORG MAERSK	27	84
SWEETBRIER WLB 405	9		T F L INDEPENDENCE	14	108	T F L LIBERTY		26	TAIKO VENTURE	24	
TAKANA	31		TALUGA T-AO-62	23	126	TAMPA	34	112	TAURUS	27	78
TEMA STAR	1		TENNESSEE	13	22	TERRIER	1		TEXACO GEORGIA	18	28
TEXACO MONTANA		17	TEXAS	6	8	TEXAS SUN		9	TEXAS TRADER	15	19
TFL DEMOCRACY	25	103	THOMAS G THOMPSON	77	94	THOMAS JEFFERSON	4		THOMAS MAERSK	20	35
THOMAS NELSON	34	84	THOMAS WASHINGTON	1		THOMPSON LYKES	13	16	THOMPSON PASS	23	31
TILLIE LYKES	38	125	TOBIAS MAERSK	8	30	TOMPEI MARU	48	28	TOKYO RAINBOW	6	101
TONAMI MARU	140	35	TONCI TOPIC	12	67	TOSCA	45		TOWNSEND CROMWELL	93	137
TOYOTA MARU 10	124	55	TOYOTA MARU 12	69	54	TOYOTA MO 24	44	52	TRANSCOLORADO	28	71
TRANSCOLUMBIA	15	70	TREIN MAERSK	9	26	TRIUMPH	43	84	TROPICANA	2	
TSU	5		TWIN JOY	29		TYSON LYKES	38	186	ULTRASEA	9	13
UNIHONGKONG	1		UNITED SEA ANGEL	23	75	UNIVERSE KURE	15	147	VALLEY FORGE	44	75
VALOR	6	27	VAN CONQUEROR	32	137	VAN FORT	1		VAN TRIUMPH	39	95
VAN WARRIOR	54	116	VANGUARD	50		VELMA LYKES	30	69	VICENTE GUERRERO	1	
VIGOROUS WMEC-627	1	44	VILLANGER	6	19	VIOLET	63	88	VOLRAY	1	
WALCHAND	3		WALTER RICE	37	131	WAY WAY	1		WECOMA	115	177
WESER EXPRESS	63	96	WESTERN SUN	2	19	WESTWARD VENTURE	67	50	WESTWIND WAGB 281	1	
WILMINGTON GETTY	49	91	WINTER WATER		6	WINTER WAVE	15	62	WISTERIA	1	
WORLD CANDOUR	25	102	WORLD SUPREME	7		WORTH	7		YAMASHIN MARU	112	58
YOCONA WMEC 166	18		YOUNG AMERICA	29	98	YOUNG SEAGULL	21		YUKON T-AO 152	11	17
ZAPATA PATRIOT	1		ZIM HONGKONG	7		ZIM MONTREAL	29	35	ZIM NEW YORK	9	
ZIM TOKYO	80	131	ZOELLA LYKES	37	111	3BK TIW	1		ATGB	14	50
ATSI	25	53	ABCV	4	27	ARIJ		184	A8W4	5	66
BMDR	50	84	CBMT	7	16	DVRL		68	D7DV	22	98
DZED		26	DZDS	7	81	DZWR		9	D8JF		70
DZWO	15	21	D8JW	20	27	D5W7	19	68	D8QE	2	93
D5QC	20	67	GSTG	28	142	D7BC	1	19	D8QN	7	78
G9CR		19	ELFY		125	ELIJ	8	12	ELOC	24	16
ELDQ	22	33	ELUU	35	72	ELXY	45	125	HDMY	18	60
H3SY	5	54	H3XV	13	21	H8CP		17	H8JO	18	1
H8LP	11	61	JCMI	28	52	JCUF	110	80	JDWY	49	89
JEOV	4	45	JUJ6	97	73	JWIC	24	62	JWZL	19	16
JLJL	53	16	JW2B	30	83	JWBY	18	64	JPWT		19
KGJB	1	4	KNRF	37	66	KLWK		39	KMWJ	30	63
KNCH		35	KPHZ	8	36	KPNL	27	19	KSFJ	14	36
KSFK	23	56	KSLB	14	64	LEVH	6	51	LEVZ		34
LICK	4	13	LION	36	100	LIQZ	7	45	NLGA		62
NNBR		469	NODZ	46	26	NOSI		33	NZEN		31
OXFU	21	41	SBHM		52	S440	35	118	S6CY	20	22
S6ED	7	17	UPFW	38	72	VRCF	67	93	VRCH	68	86
WDZB	29	143	WPBF	10	90	WJBM		4	WLBC		9
WY53261		92	WZJB876		39	WZL9190		17	ZCAV	44	14
ZCUT	47	138	ZFCR	51	105	3ENC	28	24	3FM3	18	41
3FTF	41	17	5LJJ		44	6LNY		13	6LQT	35	38
6LQR	12	91	6NMP	18	13	6M3K	13	14	6MQE	42	116
6Y54	38	8	6ZB7	7	80	6ZDO	28	44	6ZLH	38	28
6ZMM	14	101	9WTR	27	73	9MUT	94	178	9VDM		101
9VPV	39	175	9UY7	57	142						

SUMMARY: GRAND TOTAL VIA RADIO 24511 GRAND TOTAL VIA MAIL 48974

Rough Log, North Atlantic Weather

June and July 1980

ROUGH LOG, JUNE 1980--The storms this month were weak, even for a summer month. The paths over North America were more consolidated and matched climatology better than over water. There was a primary path from the central United States to over the Great Lakes and Labrador. Another path was from western Canada to the lower Hudson Bay and then into Davis Strait. The normal track along the East Coast was about 500 mi off the coast and dispersed. Off Newfoundland some of these storms turned northward, while others turned eastward. Some of the storms from Labrador continued toward Iceland. A few storms traversed northern Europe. There were none over the Mediterranean.

The most significant feature on the mean sea-level pressure chart was the Azores High at 1030 mb near 37°N, 34°W. This was 6 mb higher than normal and about 300 mi north of its normal position. There were three major ridges associated with the High: one extended into the southeastern United States; another into the Mediterranean; and an anomalous one toward Iceland, splitting the Polar Low. The Aleutian Low did not exist. Instead, there were three weak centers. One was 1008 mb near the Shetland Islands, another 1009 mb west of Goose Bay, and the third 1012 mb near Disko Island, Greenland.

The largest anomaly was plus 7 mb and centered near 40°N, 32°W. It covered the east-central ocean and bulged northward to southeastern Greenland. There was a minus 6-mb anomaly center over the North Sea which affected northern Europe. The Low near Goose Bay produced only a minus 2-mb center.

The upper air flow pattern was a closer match with climatology. The primary departure was a Low near the Faeroe Islands reflecting the surface Low near the Shetland Islands. This produced a trough over western Europe and accented the ridge along longitude 30°W. There was the normal Low over Baffin Island with a trough southward off the U.S. East Coast.

There were no tropical cyclones this month.

Extratropical Cyclones--The first week of the month the Azores High was relatively weak and split into two widely separated centers. By the 6th it consolidated into one large stubborn center over the islands it was named after and persisted for all practical purposes for the remainder of the month. Low-pressure centers were diverted northward as they came against its northwestern edge. There appeared to be more low centers than normal, but most were weak and of little concern to ships.

The first significant LOW came from north of the Great Lakes and was over Newfoundland on the 2d. At 1200 the C.S. ALERT was in the southeast quadrant with 48-kn winds (fig. 52). On the 3d the MANIFEST LIPCOWY (38°N, 61°W) was in the same vicinity with 39-kn winds. Later in the day the winds increased to 47 kn as the ship sailed eastward. By the 4th the storm had turned northeastward and at 0000 was near 50°N, 50°W, at 1002 mb. The MANIFEST LIPCOWY near 40°N, 55°W, had 48-kn winds. The LOW disappeared late that day.

Figure 52.--The LOW is centered over western Newfoundland an hour after the C.S. ALERT had 48-kn winds.

Monster of the Month--This LOW developed over New England and by 0000 on the 4th it was over Cape Cod. The CAPE BRETON HIGHLANDER found 35-kn winds off Norfolk, Va. The LOW raced eastward and at 1200 the C.S. ALERT (39°N, 65°W) again found 48-kn winds. On the 5th the storm was turning northward and there were no gales reported.

On the 6th a frontal wave was found south of the LOW. The DALAMAN was southeast of this circulation with 40-kn southerly winds and 23-ft seas. This LOW developed as the original one dissipated. At 1800 (fig. 53) the CAPE BRETON HIGHLANDER now near 46°N, 60°W, reported 62-kn northerly winds. The TROLL PARK (44°N, 54°W) had 43-kn winds from the northeast. At 1800 on the 7th the ZYBARDOW (36°N, 46°W) had 41-kn southerly winds just prior to penetrating the front. The LOW was moving northward and weakening. By the 9th it was gone.

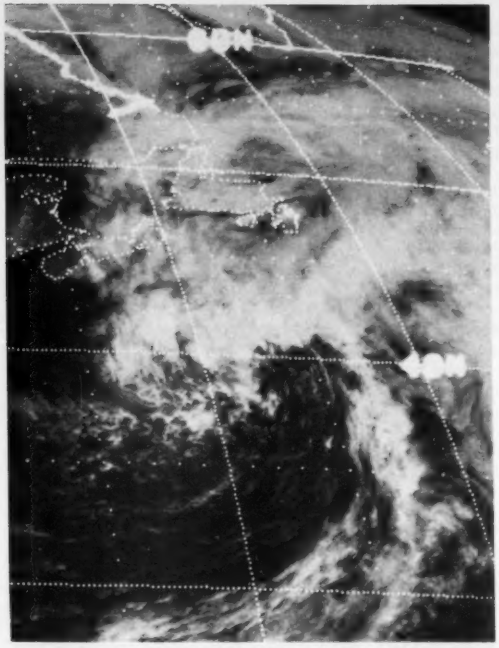


Figure 53.--The original LOW is faintly visible over the Labrador Sea. The frontal wave has become a full-fledged LOW near 40°N, 55°W, at 1800.

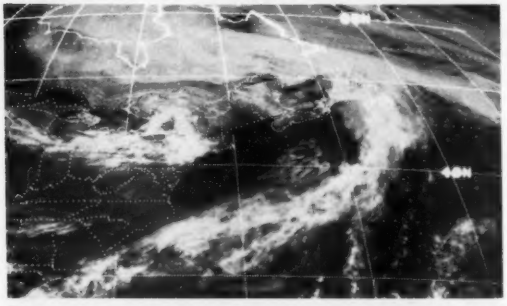


Figure 54.--The storm is centered over land, but the large circulation extended over the northwestern ocean.

This LOW was discovered south of Lake Superior early on the 7th. There were heavy thunderstorms associated with it as the storm traveled across the Lakes. Once in a while a saltie on the Great Lakes will radio a weather observation. At 1200 on the 8th the PIER radioed winds of 37 kn from the northwest on Lake Erie.

The southwesterly flow south of the warm front reached the Atlantic on the 8th. The MONTCALM was east of Delaware Bay and south of Cape Sable at 1800 with 36-kn gales. On the 9th at 0000 the ATLANTIC BEAR was near the same location with 35-kn gales. At 1200 several ships along an average latitude of 47°N had gales. At 1800 the SEATRAIN ANTWERP (40°N, 54°W) topped them all by finding 33-ft swell waves (fig. 54).

The LOW was now 984 mb over northern Quebec. It was a large LOW, and its circulation still was affecting the Great Lakes and the western Atlantic. A ship on northern Lake Michigan had 42-kn winds from the north. Two American ships near the cold front (47°N, 48°W) had gales. The LOW continued northward then turned eastward to die over Davis Strait.

On the 13th there was an ill-defined low-pressure system over Davis Strait that was a combination of the last storm described and several other LOWs. On the 1200 analysis another low center was found south of Kap Farvel. By 1200 on the 14th the 990-mb center was at 55°N, 31°W. The cold front passed a ship near 47°N, 25°W. The winds had shifted to westerly, but the 26-ft swell waves were still from the south-southeast. Ocean Weather Station Charlie was receiving 41-kn northwesterly winds and 18-ft seas in the southwest quadrant. At 1800 the C.P. DISCOVERER was within a few miles of Charlie with 40 kn also. A ship south of the center had 23-ft seas on the 15th.

Another LOW had been following closely behind this one, and yet another was moving northward over the United Kingdom. On the 1200/15 analysis, there were four weak centers supporting a large cyclonic circulation which reached as far south as 35°N. There were several reports of gales and even more of 16-ft waves. By the 16th the LOW over the United Kingdom had become the primary one and was headed toward Iceland. The CUMBRIA (46°N, 18°W) found 41-kn winds. This LOW stalled over Iceland and dissipated on the 17th.

This maritime storm originated over the Maritime Provinces on the 16th. The SEDCO 709 off Cape Race had gales as did the ZAPATA UGLAND only a few miles away. The USNS COMET had 39 kn south of Cape Sable on the 17th. The WVFN was doing a good job of reporting, but its name could not be identified. The 988-mb storm was near 57°N, 32°W, at 0000 on the 18th. A trough line had just passed OWS Charlie with 40-kn winds and 21-ft seas. Later in the day the storm passed north of OWS Lima with 40-kn winds. A U.S.S.R. ship near Lands End reported 50-kn winds from the southwest. Many others were reporting gales. The highest seas were 26 ft reported by the CALLAGHAN.

On the 19th Lima reported winds up to 45 kn and seas to 23 ft. Several ships had gales over 40 kn and seas as high as 23 ft. A Canadian ship (VCKW) at 55°N, 15°W, had 44-kn winds and swell waves following 33 ft. The storm was over Shetland Islands on the 20th bringing high gales and rough seas to the crowded North Sea (fig. 55).

The storm made a cyclonic loop east of the Faeroe Islands on the 20th and 21st and then stalled for 24 hr before continuing to loop toward Denmark. It was constantly weakening during this period.

This severe weather over the western Mediterranean was associated with a front out of a LOW that was over Norway. The cold front was moving southeastward over France and Spain on the 26th. By 1800 it was over the Gulf of Lyon, where the first ship reported gales. By noon on the 27th it had swept to Algeria and Sicily. Several French ships whose call letters could

Figure 55. --This infrared image shows that there were only low clouds (grey shade) associated with the storm, a sign of weakening.

not be identified had winds near 40 kn and waves of 8 to 12 ft. On the 28th the front lost its punch and all winds reported were below gale force.

This storm was a combination of two LOWs. One came out of the southeastern United States and moved up the coast. The other came across James Bay and eastern Canada. On the 26th the EXPORT PATRIOT off Long Island had 39-kn gales. On the 27th the SCOTSTOUN was south of Long Island with 35-kn gales (fig. 56). On the 28th the Canadian LOW took over, and the WVFN (a good reporter who could not be identified) at 47°N, 49°W, had 40-kn southeasterly winds. The storm was 986 mb near Corner Brook. On the 29th the SIR HUMPHREY GILBERT at Hamilton Inlet had 40-kn winds out of the north. The storm center continued northeastward and broke up on Kap Farvel on July 1.

Figure 56.--The two storms still have distinct circulations at 1700 on the 27th. One is over Quebec and the other south of Nova Scotia.

Casualties--The 9,110-ton American JOHN TYLER sustained heavy-weather damage on the 2d. The 378-ton Swedish tanker FURENAS and the 1,580-ton Danish ferry KARNAN collided in dense fog on the 3d outside Helsingborg. There were no injuries. Early in the month the 4,971-ton FLENSAW struck the No. 3 lock in the Welland Canal during a violent rainstorm and strong wind gusts.

On the 11th the 200-ton British QUEENFORD and the 1,833-ton Greek IRENES SUN collided in heavy fog in the North Sea. The QUEENFORD sank but her crew of three was saved. The Greek GEORGE B. SPHIKAS requested heavy-weather damage survey at Naples on the 12th. The 10,009-ton ARISTEUS and the 86,098-ton NORDIC CRUSADER collided in fog in the North Sea on the 12th. The 1,587-ton ARGO GLORY had heavy-weather damage on a voyage from New Orleans to Port of Spain. The 4,735-ton Panamanian FAIR REEFER suffered heavy-weather damage on a voyage to Poland on June 20 to 22.

The two Canadian lakers ALGOBAY (22,850 tons) and the MONTREALAIS (17,647 tons) collided in fog on the St. Clair River on the 25th. The 16,628-ton HILDA MARJANNE had her ice-damaged propeller blades replaced at Port Colborne this month.

Other Casualties--The Liberian tanker BILBAO encountered heavy weather during June 5 to 22 from Iraq to Portugal. The Greek bulkcarrier APOSTOLOS ANDREAS and the tanker ZAKYNTHOS collided in fog at San Vicente on the 12th.

ROUGH LOG, JULY 1980--The cyclone tracks this month did not compare at all well with climatology. The tracks of the storms over Canada and the northern United States were very diverse. Very few managed to make the transition from continental to maritime. The most preferred track over water was from the Gulf of St. Lawrence to the North Sea. As the storms approached western Europe they tended to diverge. The primary climatological track and area of cyclogenesis off the U.S. East Coast did not exist. As expected in a summer month, the cyclones were weak.

The mean sea-level pressure pattern reflected the diversity and weakness of the maritime storms. The primary feature, of course, was the Azores High at 1028 mb. The center was near normally located at 35°N, 42°W. There was the usual ridging into the southeastern United States and western Europe. The European ridge was over the Mediterranean, farther south than usual. A usual slight ridge toward Greenland was accented and toward Iceland. The Greenland High, usually over the ice cap, spanned the Greenland and Barents Seas.

The normally weak low-pressure centers were displaced. The climatically strongest one was 1007 mb over Hudson Bay rather than Cape Chidley. The normal 1010-mb Low over Iceland was 1012 mb north of Ireland, and the normal 1010-mb Low over northern Sweden was 1011 mb over Denmark.

Although the pressure departures were not large, they were significant in reflecting the cyclone tracks. There was a large elongated area of negative values across Europe between latitudes 50° and 55°N. There was a large positive area of up to 6 mb over the Greenland and Barents Seas.

In the upper air at 700 mb the primary Northern Hemisphere circulation center was shifted from the North Pole to over Devon Island in the Queen Elizabeth Islands. The east coast trough was shifted westward to Hudson Bay. A discontinuity occurred over southern Canada, and the trough shifted to off the U.S. East Coast. The usual trough along longitude 10°W was accented by an anomalous High over the Gulf of Bothnia.

The first tropical cyclone, Allen, was a depression on July 31. (See Hurricane Alley.)

Extratropical Cyclones--The Azores High was a steady feature slightly southwest of the Islands, ocasionally drifting into Europe and splitting with a second center becoming the Bermuda High. There was the permanent heat Low over the Sahara.

The first storm came out of the Plains and traveled along the Canadian-United States border. The storm was 992 mb over the Gaspe Peninsula at 1200 on the 6th. Heavy rains were widespread, and the town of Grande Vallee was hard hit by flooding with damage estimated at over $1 million. The northeastern part of the Gaspe Peninsula was hardest hit. Power outages were not completely restored until the 8th. The first high-wind report was from a SHIP near 35°N, 73°W, of 52 kn in a thunderstorm along a trough line. The U.S. ship KFDZ (39°N, 67°W) had 43-kn winds and 13-ft waves. At 1800 the SEA-LAND GALLOWAY, 350 mi south of the center, had minimal gales. The PROVO WALLIS (44°N, 63°W) started the day with 47-kn westerly winds. The ATLANTIC PRELUDE was east of Halifax, Nova Scotia, within 4 mb of the storm's center with 50-kn winds. A ship south of St. Pierre had 20-ft swells from the south-southwest. A new LOW formed near the point of occlusion (fig. 57). On the 8th the FREDERICK CARTER near Sidney had 45-kn winds blowing through Cabot Strait. The new center was moving northward. The GRONLAND was just off Kap Farvel on the 9th with 44-kn winds from the east. The weather station was plotted as 45 kn. A ship called the seas 20 ft. The storm split on Kap Farvel with the eastern center surviving and moving eastward. No further gale reports were received, and the center reverted to a trough on the 12th.

This LOW was discovered north of Sept-Iles on the 16th. Cape Race and a Canadian ship just to the south both had 35-kn winds. Neither reported waves. The WVFN (47°N, 49°W) also had 35-kn gales on the 17th. By 0000 on the 18th the 1000-mb storm was at 54°N, 40°W. The C.P. DISCOVERER (56°N, 43°W) was northeast of the center at 0600 with 44-kn winds and 12-ft seas from the northeast. The storm was racing eastward and was over Scotland at 1200 on the 19th and was over the Skagerrak on the 20th. The northerly flow over the North Sea brought gales to the many ships and platforms there. The VULCANUS off Helgoland recorded 41-kn gales and the VENDEE off Brest had 40 kn. On the 21st most of the winds over the North Sea were in the upper 30's, but two reports in the vicinity of 56°N, 02°E, had 44 kn. The storm disappeared on the 22d.

Cape Race produced this storm on the 21st. Several stable waves had occurred along the front in that area, but this one was unstable and expanded. It raced eastward and at 1200 on the 23d was near 44°N, 29°W, at 990 mb (fig. 58). The ALAIN L.D. (42°N, 34°W) re-

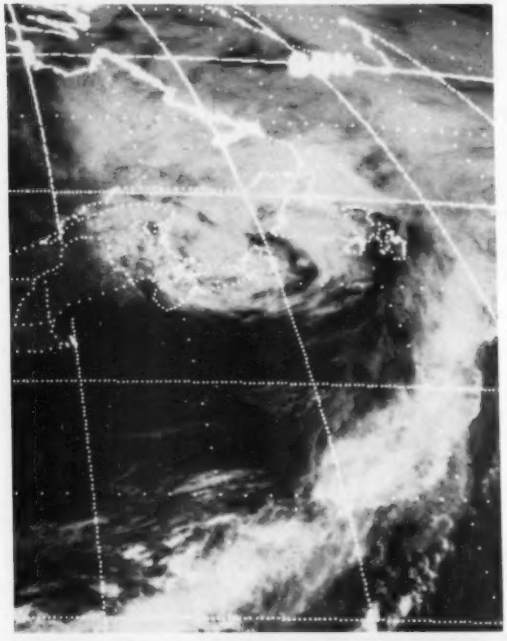


Figure 57.--The storm is over Cabot Strait, and there are indications of a circulation southeast of Cape Race at 1700 on the 7th.

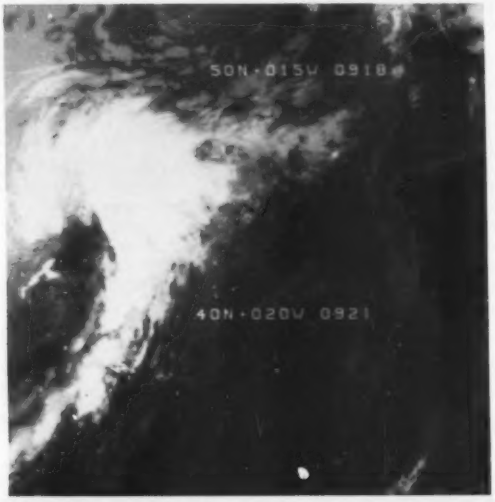


Figure 58.--By 1200 the ALAIN L.D. and the group of thunderstorms near 42°N, 32°W, have met, resulting in the high winds.

ported 68-kn winds, which seemed high for the pressure gradient and season. Her seas were 20 ft, and there was rain in sight. The clouds were coded as cumulonimbus, so there were probably strong winds associated with these and the instability. The BISCHOFSTCR (41°N, 34°W) had 39-kn gales at 1800. At about that time the LOW must have passed nearly directly over the CAST PETREL. At 0000 on the 24th she had 41-kn northerly winds. Past weather indicated thunderstorms. Later in the day the WILD FLAMINGO (44°N, 19°W) had 45-kn winds and 25-ft waves. On the 25th OWS Romeo measured winds over 40 kn and seas as high as 25 ft. The storm was traveling northeastward and dissipated over the Irish Sea on the 26th.

Another unstable frontal wave formed east of Trinity Bay on the 24th. The AMERICAN ALLIANCE found 35 kn as the front crossed her path. At 0000 on the 26th both the DART AMERICA and DART CANADA were sailing westward in the storm. The AMERICA had 53 kn from the southeast, and the CANADA had 42 kn from the west with 20-ft swell waves (fig. 59). At 1800 the AMERICAN ACE (48°N, 27°W) was on the receiving end of 45-kn winds, and the SEA-LAND PACER (49°N, 22°W) had northeasterly 40-kn winds with 20-ft swells.

The storm was headed into the Bay of Biscay on the 28th, when it suddenly turned northward. OWS Romeo had 20-ft seas from the north. The storm weakened with the shift in direction, but it intensified again on the 30th. Several ships again reported gales. On August 1 the storm stalled until the 3d near 55°N, 25°W.

Tropical Cyclones--Hurricane Allen became a tropical depression on July 31 and thus will go down in history as a July storm. He will also be remembered as the strongest storm ever in the northwestern Caribbean Sea and for the second lowest measured pressure over the North Atlantic. See Hurricane Alley, page 353, for a description.

Casualties--The 15,414-ton Greek GEORGIS PROIS and 4,576-ton Greek KAPETAN ANTONIS collided in fog between Cape Race and St. Pierre on the 1st. On the 7th, the 15,494-ton Spanish SERANTES and the 5,888-ton Pakistani TAXILA collided in fog 18 mi west of Gibralter . The pipe-laying barge No. 27 suspended operations in the North Sea because of bad weather on the 10th; the stinger was reported sunk. The Panamanian PANAGIA SPILIANI was at Tunis on August 1 with heavy-weather damage that occurred during July 22 to 30. The 39,260-ton Liberian CARBAY discovered apparent heavy-weather damage from a voyage from Hampton Roads to Rotterdam while in drydock. The British

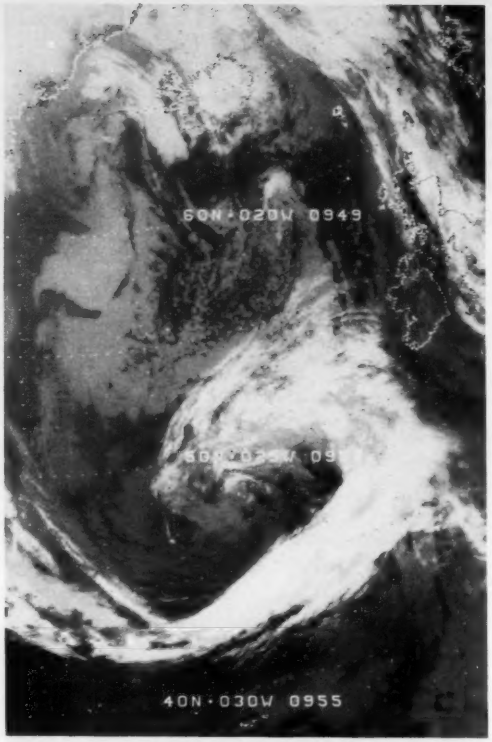


Figure 59.--The storm is well outlined by the high cold clouds (white), but there were widespread low clouds (grey).

KING RICHARD reported heavy-weather damage at Lisbon on the 25th. On the 31st two Canadian fishing vessels collided in fog southeast of Halifax. The KATE BEAVER rescued 14 crewmen from the MARGARET AND JANE, which sank, with 4 crewmen missing.

Other Casualties--The Saudi Arabian AMAL drifted in strong winds while anchored at Jeddah and grounded. The 8,915-ton Greek JADE reported severe storm conditions near 38.3°S, 39°W, and shifting of cargo on the 3d. The 10,732-ton Liberian ATHLOS apparently sank on the 30th, 1,000 mi northwest of Cape Town in storm seas. She took on water after springing a leak in her hold. The 28 crewmen were rescued by the PORSANGER.

Rough Log, North Pacific Weather

June and July 1980

ROUGH LOG, JUNE 1980--Severe storms were few and far between this month. There were many short-lived frontal waves which are not pictured on the monthly cyclone track chart. The major path of cyclones this month was an anomalous one from the west shore of the Sea of Japan and along the western Bering Sea. Some storms developed off Honshu that traveled east to northeast and generally dissipated over midocean. Farther to the east in the vicinity of 45°N, 170°W, storms developed that moved northeastward toward Bristol Bay.

The mean sea-level pressure pattern was completely dominated by the 1030-mb Pacific High centered near

40°N, 150°W. There was no indication of an Aleutian Low. There was a 1005-mb low center over eastern Siberia and a 1013-mb low center over the Yukon. Climatology indicates a 1010-mb Aleutian Low north of Adak Island and a 1011-mb LOW over Alaska. The Pacific High is normally 1024 mb.

The anomaly pattern was dominated by a plus 11-mb center near 46°N, 160°W. Most of the North Pacific north of latitude 20°N had pressure above normal. The only negative anomaly center was minus 5 mb over eastern Siberia.

In the upper air at 700 mb the pressure level was higher than normal in general. A trough with a weak LOW supported the surface LOW over Siberia. The height 600 mi south of the Alaska Peninsula was up to 400 ft above normal.

There were four tropical cyclones: tropical storm Herbert over the western ocean and hurricanes Agatha and Celia and tropical storm Blas over the eastern ocean.

Extratropical Cyclones--The Pacific High was one of the primary controlling factors in the tracks of the cyclones. The HIGH started the month off the U.S. West Coast. Toward the end of the first week, it weakened temporarily. During the second week it elongated east-west, and by the third week it was in place over the central ocean. It then drifted and built eastward and was again off the U.S. West Coast on the fourth week.

The first gales were associated more with the Pacific High than the LOW, which was inland over the Rocky Mountains. One of the first reports was by a ship off Cape Blanco late on the 1st of 35 kn. On the 2d the OGDEN FRASER found 35-kn northwesterly winds off Vancouver Island. On the 3d the SPRAY CAP reported 50 kn south of Cape Blanco. The OGDEN FRASER was sailing northward and found 43-kn gales west of the Queen Charlotte Islands. The gradient relaxed on the 4th.

A frontal system moved eastward across Japan on the 3d. By 1200 on the 4th a new circulation had formed around the occlusion and was near 44°N, 165°E. The PACHACHA (35°N, 171°E) had southerly 45-kn winds. Another ship with the call letters BPLI estimated the winds as 41 kn near 36°N, 163°E. This one spurt of energy seemed to be all the storm contained, and it steadily weakened.

The junction of the Amur and Zeya Rivers was the birthplace of this storm. It moved over the Sea of Okhotsk on the 8th and the Kamchatka Peninsula on the 9th. At 0000 on the 10th the LOW was 998 mb near 52°N, 165°E. The SPRAY CAP was near 49°N, 167°E, with less than 1/2-mi visibility and 47-kn southwesterly winds. The waves were 15 ft. The system was traveling eastward at 25 kn. The KOULOUNDA (54°N, 161°W) northeast of the center had 52-kn winds from the southwest. On the 12th the storm was moving into the Gulf of Alaska. The ROKKOHSAN MARU and the H8DE, both near 53°N, 150°W, had 35- and 40-kn winds, respectively. Late on the 13th two U.S.S.R. ships, probably fishing vessels, were near 54°N, 161°W, with gales. The storm stalled on the 13th and 14th near 58°N, 145°W (fig. 60). There were 30- to 40-kn winds along the Alaska Peninsula as reported by the AMERICAN VIKING, GAIL WIND, and WALTER N. The fishing vessel MICHAEL LEE sank near Port Moller, where the WALTER N. reported 30 kn. It was not specified if weather was a factor. The storm began moving southward on the 15th and faded from the scene.

This was one of the storms that formed off Honshu, but it was not typical in that it moved more northward than the majority. It was first detected on the 10th. The NEW GOLDEN PHOENIX (45°N, 162°E) was north of the storm on the 11th and found easterly 50-kn winds most of the day. At 0000 on the 12th the storm was near 53°N, 156°E, at 984 mb. The OGDEN FRASER was about 400 mi southwest of the center with 45-kn winds from the north. On the 13th the BELLMAN found 48-kn winds (fig.

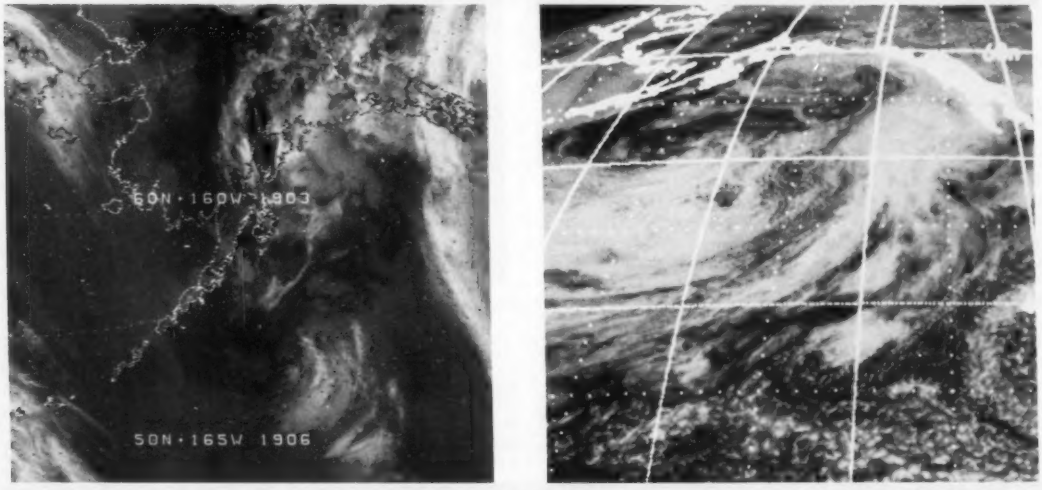


Figure 60.--Two views of the same storm only 1 hr 42 min apart. The left view is an infrared image by a NOAA polar-orbiting satellite, and the right view is a visual image from the NOAA stationary satellite at 135°W.

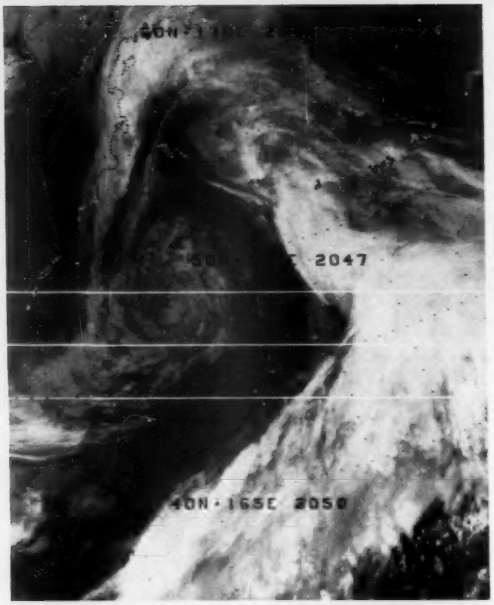


Figure 61.--The center of the storm has lagged far behind the frontal system. The wedge shape near 45°N, 175°E, indicates the location of the occlusion.

61). A U.S. ship southeast of Adak Island on the 14th had 37-kn winds and the fishing vessel WENDY FOSS had southeasterly winds of 40 kn near Dutch Harbor late in the day. On the 15th the storm turned westward toward Kamchatka. The front stretched far to the east, and the CALEDONIAN FOREST found 54-kn southerly winds at 50°N, 164°W, near the front. On the 16th the LOW disappeared.

This storm came out of Manchuria. On the 18th it was 989 mb south of the eastern tip of Hokkaido. The first gales were found by Soviet fishing vessels off Ostrov Kunashir. On the 19th the storm was moving northeastward as it was deflected by the Pacific High over midocean. Four ships west, south, and east of the center found gales. The gradient was tightest south and east of the front. A ship slightly south of the cold front near 36°N, 156°E, had 25-ft waves. The storm's influence was reaching eastward along the Aleutians. Bethel and Cold Bay had 46-kn winds. The OREGON (56°N, 170°W) had 40- to 50-kn winds with heavy rain and 1/2-mi visibility. Others were reporting 30- to 45-kn winds. The UNITED SPIRIT had 40-kn winds on the 20th near Adak Island. On the 20th the storm moved through the Bering Strait.

As the point of occlusion of the front from the storm above moved eastward across the Alaska Peninsula, a LOW formed. Gales started blowing late on the 22d. The SUNNY WEALTH (52°N, 149°W) was about 300 mi south of the 991-mb center with 45-kn winds. Six hours later the TOZAN MARU brought 42 kn into the game. At 1200 the THOMAS G. THOMPSON reported 40 kn, while only a few miles from OWS Papa who was reporting 36 kn and 16-ft waves.

The storm was traveling southeastward off the British Columbia coast on the northeast side of the Pacific High and weakening.

This storm was exported out of a port on the Yellow Sea. The NEW GOLDEN PHOENIX was in the Sea of Japan with 35 kn out of the northwest on the 26th. The storm moved across Honshu and was near 40°N, 151°E, at 1200 on the 28th at 990 mb. The circulation had spread and consolidated. Several ships, including the CANADA MARU and the FORT NELSON, found gales both west and east of the center. Waves of 13 ft were the highest reported. On the 29th the EASTERN RIVER (40°N, 151°E) had 40-kn winds. The SOUTHERN HIGHWAY had 16-ft waves 300 mi south of the center. Isolated gales continued into the 30th, but the storm died by July 1.

Tropical Cyclones, Eastern Pacific--Hurricane Agatha came to life on the 9th about 150 mi southwest of Clipperton Island. Heading slowly northwestward, she intensified to tropical-storm strength late in the day and became a hurricane the following day. Agatha intensified slowly. By the 11th, after crossing the 10th parallel near 115°E, winds climbed to 85 kn near her center (fig. 62). Early on the 12th they were up to estimated 100 kn. Gales extended 150 mi in all directions. This was Agatha's peak. She began turning west-northwestward and by the 13th had moved into a region of relatively cool water. Sea-surface temperatures ran about 75°F and satellite photos showed weakening. She had dropped to tropical-storm strength before the day was out. Agatha dissipated on the 15th west of 135°W and south of 20°N.

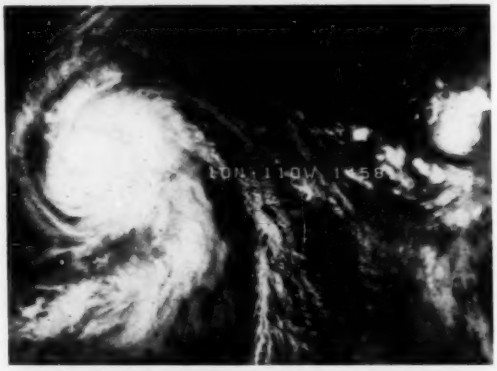


Figure 62.--Agatha in all her finery. She has a feathery bow trailing as she parades westward.

While Agatha was falling apart in midocean, tropical storm Blas was coming together just north of Clipperton Island. By 0000 on the 17th the tropical storm was centered near 12.3°N, 110.5°W. Heading northwestward, under the watchful eye of the Eastern Pacific Hurricane Center, Blas reached peak intensity on the 18th. Maximum sustained winds climbed to 45 kn. It was not until late that same day that the slow-moving storm crossed the 15th parallel, near 115°W. The following day he

weakened to a depression.

Toward the end of the month hurricane Celia popped up some 450 mi southeast of Manzanillo. Moving westward on the 25th, Celia became a tropical storm. The following day, near 15°N, 108°W, she attained hurricane status. She also made a fatal error by turning toward the west-northwest. She headed for an area of increasing wind shear and cooler water. Celia remained a minimal hurricane until the 28th (fig. 63). Late in the day she came under the influence of an upper level trough. Quickly she lost all upper level support. She dissipated by the 30th.

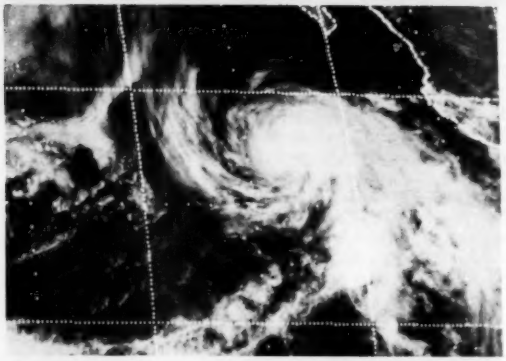


Figure 63.--Hurricane Celia does not appear as well organized as many tropical storms at 2045 on the 27th.

Tropical Cyclones, Western Pacific--Tropical Storm Herbert originated about 650 mi south of Hong Kong on the 24th. After moving rapidly toward Vietnam he gradually slowed and turned northwestward. Herbert reached tropical-storm strength early on the 25th (fig. 64). Later in the day a reconnaissance plane reported 45-kn surface winds around a 992-mb pressure center. Herbert's center passed over the Paracel Islands between Xishadao and Sanhudao on the 26th. Winds at the time were 42 kn with gusts to 62 kn. The storm intensified slightly after passing the Paracels on a northwestward track. However, Herbert weakened after crossing Hainan late on the 26th. Once in the Gulf of Tonkin he began to turn westward just before reaching the south China coast on the 28th. Late that afternoon he moved ashore about 110 mi east-northeast of Hanoi.

Casualties--The Japanese ferry FERRY AKASAI for Kobe grounded in fog on the 2d. On the 8th the KYUDAI MARU and the DONG JIN No. 11 collided in fog 36 mi north of Cheju Island. The TOYO MARU No. 16 laden with 258 Mazda cars collided in fog with the NICHIWA MARU with 538 Datsun cars off Cape Kajetori on the 10th. The TOYO sank and the crew of 11 were rescued by the NICHIWA. Fog was still the culprit. The TAIHEI MARU and KUNITOMO MARU collided in dense fog off Komatsushima on the 16th.

The 8,566-ton PRINSENDAM was at Vancouver on the 17th to have ice damage repaired which occurred in Glacier Bay on a voyage from Vancouver to Alaska. Two South Korean hydrofoil passenger vessels, the ANGEL No. 1 and ANGEL No. 2, collided in fog in Chinhae Bay on the 24th. At least four passengers died with many including crew injured. The TOHO MARU No. 13 and the GALLEON ONYX collided in fog off Hokkaido. The TOYO MARU capsized and four of eight crewmen were rescued.

The American tanker WILLIAMSBURGH sustained heavy-weather damage during June 19 to July 1. The GRAND ZODIAC had heavy-weather damage on a voyage from Coos Bay for Japan. The container vessel SUNSHINE ISLAND encountered heavy weather in June from Pusan to the United States and lost containers overboard.

Other Casualties--The Liberian BELLA (9,287 tons) had damage from a cargo of logs, part of which broke adrift in heavy weather in the Indian Ocean on June 3 to 9. The 32,360-ton SAUDI-FILIPINAS 1 sank in the Indian Ocean on the 9th while under tow by the tug SUMATRAS in force 9 to 10 winds. The Greek SUNRISE diverted to Bombay owing to water in the engineroom from heavy weather. The 11,207-ton VILLANGER developed a list of 12° during bad weather off Chile on the 14th.

The Panamanian GOLFE DE TADJOURAH struck rocks and grounded on the 11th near the Oman coast in poor visibility and rough seas. Eleven of the 16 crew survived.

The 11,188-ton American SANTA MARIANA alleged weather damage on the 15th and 16th from Buenos Aires to Valparaiso. The ERSKINE BRIDGE reported the flukes and swivel of the starboard anchor were damaged on the 18th off Port Kembla because of heavy seas.

The BARON WEMYISS, a British bulkcarrier arrived Auckland on the 22d as a port of refuge following water ingress during heavy weather. On the 23d the PING CHAU and the HADI contacted during heavy weather while at anchor at Bombay. The Singapore CHERRY MAJU grounded at the port of Karwar, India, with large list. All the crew were rescued, but monsoon weather prevented reboarding.

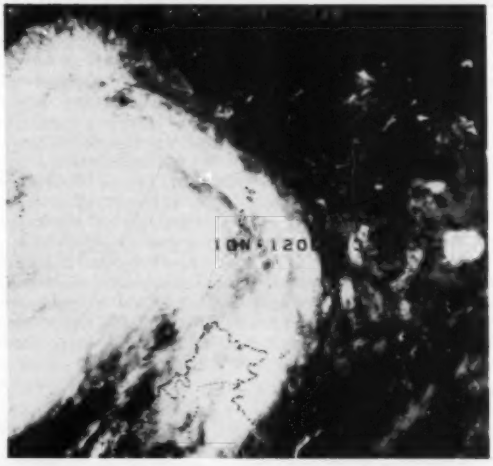


Figure 64.--Herbert, not yet a tropical storm, is buried in this massive cloud shield near 14°N, 115°E, about 350 mi west of Manila late on the 24th.

ROUGH LOG, JULY 1980--There appeared to be about the average number of extratropical cyclones crossing the North Pacific this month. None were very severe. The primary storm path followed a mean path between the two paths indicated by climatology. The storms originated near Honshu and tracked slightly north of eastward to about 160°E, where they turned northeastward toward Bristol Bay. Several storms took circuitous paths across the Bering Sea.

The 1030-mb Pacific High normally centered near 40°N, 150°W, was the dominant pressure feature. This was 5 mb higher than normal. No closed Aleutian LOW is indicated on the monthly normal sea-level pressure chart, but there was an anomalous 1007-mb Low north of Kamchatka this month. There was also an anomalous 1019-mb High over the Arctic Ocean north of Point Barrow. The few storms that continued over Alaska and into Canada moved through the weak area between the two Highs.

The two significant anomaly centers were both positive; a 5 mb centered with the Pacific High and an 8 mb with the High over the Arctic Ocean. A weak negative anomaly area stretched from Hudson Bay westward into eastern Siberia.

The surface Low over Siberia was reflected at 700 mb as a closed circulation. The trough along the Asian coast was sharpened. Also, the ridge over Alaska and the western Canadian coast was intensified.

There were 10 tropical cyclones this month, 5 over the western ocean and 5 over the eastern ocean. They were tropical depression 10, tropical storm Ida, and typhoons Joe, Kim, and Lex in the west; and tropical storms Darby, Estelle, and Frank, and hurricanes Georgette and Howard in the east.

Extratropical Cyclones--The month started with the Pacific High firmly entrenched north of Hawaii and west of northern California. No storm or frontal system made any significant inroads until the 20th. At that time the Pacific High split into two to three weak cells, and the cyclones and fronts were able to penetrate farther south. By the 27th the Pacific High was consolidating over midocean, and during the first week in August was settled again in its usual location.

This LOW in the trough of a storm over the Bering Sea existed on the 1st. It traveled northeastward and by the 3d announced its existence. The JAMAICA MARU (46°N, 175°W), 225 mi east of the center, had 48-kn winds from the southeast. She still had 40-kn winds on the 4th. At 1800 the American KHRH had 39-kn winds near 48°N, 163°W. The storm passed slightly west of Saint Paul Island on the 5th (fig. 65). At 1500 the MARINER was south of Kodiak Island with 40-kn southerly winds. On the 6th, 7th, and 8th the storm made a cyclonic loop south of Saint Lawrence Island and dissipated over Alaska on the 9th.

Monster of the Month--This storm came out of the Yellow Sea on the 1st. It traveled along the northern shore of Honshu and was over the open water on the 3d. Soviet fishing vessels in Tatar Strait were receiving gales, as were ships along the front south of Japan. The storm had multiple centers and was of no concern until it consolidated into one center on the 6th. The DAIRIN MARU was north of the center with 36-kn winds out of the northeast. At 0000 on the 7th the 992-mb storm was at 43°N, 173°E. The OCEAN LEAP (39°N, 177°W) was in the frontal zone with 41-kn winds from the south-southeast. On

Figure 65.--Late in the day the storm has moved inland over Alaska.

the 8th the DAIRIN MARU (48°N, 177°E), which was following the storm, had 40-kn winds and 12-ft seas. At this time the storm turned a cyclonic loop, completing it on the 9th and heading northward. This was odd for the storm's location; usually storms do this much farther north. The PRESIDENT CLEVELAND was sailing southward in the southeast quadrant and had 35-kn gales and 12-ft seas. Her winds were 40 kn on the 9th (fig. 66).

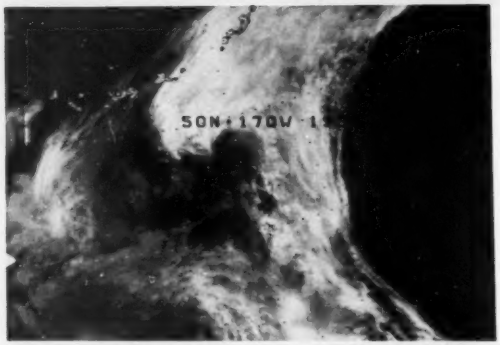


Figure 66.--There are only a few low clouds near the center of the storm. The cold front east of the center stretches to the south-southeast and the warm front to the east-northeast. There is high pressure north of the Aleutians.

The NANCY LYKES (40°N, 169°W) was near the front on the 10th and her report read 60 kn with 23-ft waves. The storm was moving northeastward against the 1034-mb Pacific High. On the 11th a SHIP (48°N, 175°W) southwest of the storm reported 25-ft seas. Still farther south the SINCERE No. 5 reported 20-ft swells. The PRESIDENT PIERCE had gales at a pressure of 995.6 in the 994-mb storm as the storm switched to a more southerly center. At 0000 on the 12th the new center was near 53°N, 167°W. The strongest winds were in the southeast quadrant. The JAPAN RAINBOW had 48 kn, the SHIMA MARU had 45 kn, and a SHIP at 49°N, 166°W, had 25-ft seas. By the 13th the storm was very weak.

A long frontal system extended southward from Alaska to 35°N and then westward to Japan and on to tropical storm Ida near Taiwan. At 1200 a frontal wave was analyzed over Honshu. Gales were blowing on the 12th.

The storm was 988 mb near 40°N, 160°E, on the 13th. The KAMNIK (37°N, 151°E) had 44-kn northerly winds. The PRESIDENT ADAMS (47°N, 166°E) had easterly 40-kn winds, while the TOYOTA MARU, south of the center, was sailing into 20-ft seas. Two Japanese ships near 41°N, 168°E, had 40-kn gales and 20-ft waves on the 15th. There were a few minimal gales until the 17th, when the winds decreased to only breezes.

The remainder of the month was quiet with no well-organized extratropical storms. There were a few isolated gale reports here and there. Throughout the month there were gale reports off the U.S. West Coast as the Pacific High pushed eastward and the heat Low over the interior desert intensified.

Tropical Cyclones, Eastern Pacific--Darby was the first of a number of short-lived tropical cyclones that roamed these waters in July. She formed on the 1st near 13°N, 110°W, and dissipated on the 3d. Darby moved westward. Her winds peaked at 45 kn on the 2d.

From the 12th through the 28th tropical storms Estelle and Frank, along with hurricane Georgette, all developed south-southeast of Socorro Island. Estelle was already a tropical storm when discovered on the 12th. Her winds reached 40 kn, but after moving west-northwestward, she quickly dissipated the following day. Frank flared briefly on the 18th. He moved in a more westerly direction, peaked at 45 kn on the 20th, then died on the 22d. Six days later Georgette put in an appearance. On a northwesterly heading, she reached hurricane strength by the 29th, when winds briefly climbed to 65 kn (fig. 67). The following day she was downgraded to a tropical storm and by the 31st was finished. All these storms suffered from cool surface water and a lack of upper level support.

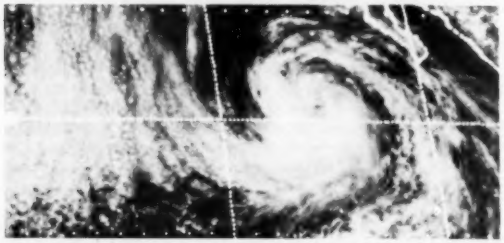


Figure 67.--Georgette has several feeder bands and a small eye.

Just before the month closed hurricane Howard developed about 300 mi east of Clipperton Island. By the August 2 he had reached hurricane strength near 13°N, 111°W. He headed northwestward. Maximum winds rose to 80 kn and then peaked at 90 kn on the 3d (fig. 68). However, as Howard approached 20°N, cooler waters dampened his enthusiasm. Late on the 5th he dropped to tropical-storm intensity. By the 7th, as he crossed 25°N near 121°W, Howard was a minimal tropical storm and sinking fast.

Tropical Cyclones, Western Pacific--Tropical storm Ida developed on the 6th just east of the southern Mariana Islands. The following day the CHIKUMASAN MARU, sailing northward, encountered 35-kn winds about 120 mi north-northwest of Ida's center. Ida was moving west-northwestward. By the 8th winds near her center climbed to 55 kn. Early the following day they

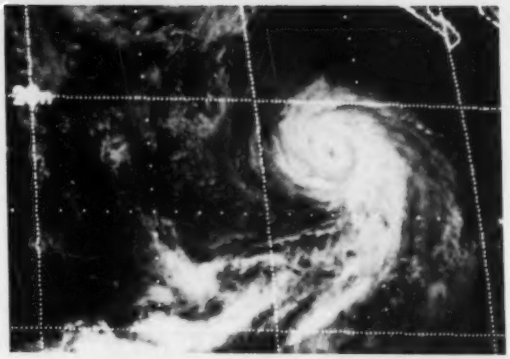


Figure 68.--Hurricane Howard at 2145 on August 3 is approaching latitude 20°N.

briefly reached 60 kn as Ida entered the Formosa Strait. The 5,486-ton Philippine REYNA FILIPINA dragged anchors in rough seas and strong winds on the 9th in Manila Bay. A reconnaissance aircraft reported a 979-mb pressure. Ida very nearly became a typhoon. She passed close to Basco Island early on the 10th, where a minimum pressure of 982 mb was reported. The BENVALLA, about 40 mi from Ida's center, reported winds of 57 kn with gusts to 75 kn. Early on the 11th, Ida began to turn northwesterly toward the south China coast. She passed 150 mi to the east-northeast of Hong Kong, where wind gusts ranged from 30 to 50 kn. Ida crossed the coast near Shantou, which recorded a 985-mb pressure with 38-kn winds and gusts to 52 kn.

On the 15th a tropical depression formed some 520 mi east of Manila. Initially, it moved rapidly west-northwestward but turned westward and slowed on the 16th. It moved across Luzon close to Manila that evening. On the 17th the ill-defined center, now in the South China Sea, swung towards the northwest and accelerated. That night it slowed and intensified to minimal tropical-storm strength. The following day the VISHVA APURVA encountered 36-kn winds about 110 mi from the center, while the PARONGA reported 37-kn winds some 60 mi from the center. Central pressure was estimated at 996 mb. The system continued northwestward and made landfall near St. Johns Island on the 19th. Later it degenerated into an area of low pressure near Nanning in southwest China.

Typhoon Joe developed from a low-pressure area about 160 mi west-southwest of Guam on the 17th. Moving west-northwestward at 14 kn he reached tropical-storm intensity the following day. By the afternoon of the 19th an eye had formed and Joe was a typhoon (fig. 69). Reconnaissance aircraft reported 65-kn surface winds around a 974-mb center. The following evening Joe was generating 100-kn winds around a 940-mb center with a circulation of more than 400 mi in diameter. Early on the 21st he crossed Luzon causing damage to plantations and crops. According to press reports, about 50,000 Philippinos lost their homes and two fishermen died. Joe weakened over Luzon, but he reintensified over the South China Sea. Early on the 22d maximum winds were estimated at 80 kn. The SAMOA encountered 58-kn winds 150 mi from the center, and the APOLLO PEAK about 40 mi from the center reported 57-kn winds and a 973-mb

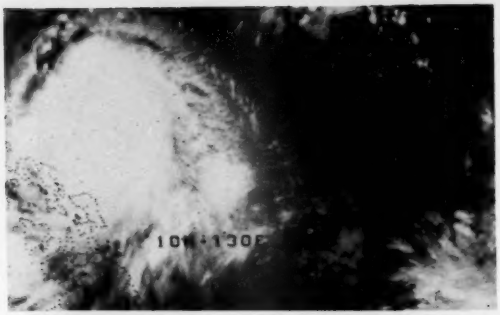


Figure 69.--Joe is not yet a typhoon and has not developed the traditional eye at 2245 on the 19th. A few hours later he had both the eye and 65-kn winds.

pressure. Joe crossed the Luichow Peninsula on the 22d. According to Chinese newspaper accounts, the typhoon caused 188 deaths and was the strongest in 26 yr. The island station at Bach Longvi recorded 62-kn winds and a sea-level pressure of 980 mb early on the 23d. Joe then turned westward and crossed the Vietnam coast near Hanoi. He weakened rapidly once over land.

Typhoon Kim developed as a tropical depression some 330 mi southeast of Guam on the 20th. Moving steadily toward the west-northwest at 17 kn she intensified into a tropical storm by the 22d. Kim reached typhoon strength the following day some 420 mi east-southeast of Manila (fig. 70). Satellite photos, on the 24th, indicated a distinct eye and a circulation that had broadened to 600 mi in diameter. Later in the day a reconnaissance aircraft reported maximum surface winds of 110 kn around a 916-mb pressure center. Kim hit the coast of Luzon early the next morning. Her devastation included 31 deaths and 8 people missing. Some 12,000 homes were destroyed as 500 villages were flooded. After crossing Luzon Kim weakened and entered the South China Sea on the evening of the 25th. The next morning the JAPAN IRIS encountered 58-kn winds about 80 mi from the center. Later Pratas Island recorded winds of 32 kn when Kim was 80 mi to the southeast. Kim was downgraded to a tropical storm. About 120 mi southeast of Hong Kong, on the 27th, Kim turned northward. She crossed the south

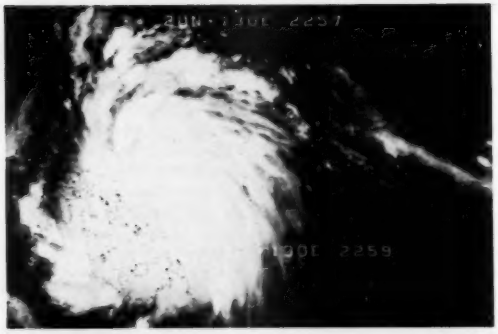


Figure 70.--Kim is poised to give the Philippines another blow less than a week after the devastation by Joe.

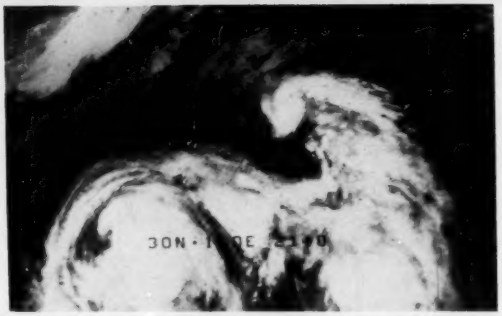


Figure 71.--Late on the 4th Lex is weakening and headed for a rendevous with the cold front to the northwest.

China coast some 55 mi southwest of Shantou, where maximum gusts of 70 kn were reported. Gusts in the Hong Kong area ranged from 42 to 69 kn.

Typhoon Lex developed about 300 mi west of Marcus Island on the 29th. While he was hesitant about a course, he organized rapidly and reached typhoon intensity by the 31st. At this time Lex was heading west-southwestward. By the 2d, packing winds of 75 kn, he turned northward. Winds climbed to 80 kn late in the day and into the 3d. The DAMPIER MARU, which was sailing northward and catching up to the storm, was running in 20-ft swells from the 1st through the 3d. On the 1st she reported 40-kn winds 180 mi southeast of Lex's center. The storm began to weaken and slowly turn extratropical as Lex swung toward the northeast on the 5th (fig. 71). He was still a potent storm, however, as testified to by the ATLANTIC PIONEER, which ran into 20-ft swells in 54-kn winds some 360 mi east of the storm's center. By the 7th Lex had completed his extratropical transformation as he crossed the 35th parallel near 155°E.

Casualties--The 83,601-ton American LNG LEO parted a mooring rope on the 2d in high winds at Kobe damaging the pier and ship. The 38-ton fishing vessel SEA FINN and the 30,340-ton MILROSS collided in rough seas off Oahu on the 7th. The SEA FINN sank. The husband and wife owners were injured but rescued. The 697-ton DAISEN MARU and the 3,000-ton BONNY OCEAN collided in dense fog on the Inland Sea on the 7th. Two small Japanese vessels, the 159-ton KINPUKU MARU and the 499-ton KOYO MARU collided in fog on the 8th. The former sank and both crewmen were rescued.

The American frigate MEYERKORD and the 2,515-ton SENSHO MARU collided in dense fog off Matsuyama. There were no injuries. The Panamanian BLUE RIVER (4,259 tons) sank 300 mi southeast of Manila on the 12th. She was struck by large waves off Catandunanes Island. The Greek PROSO requested a weather-damage survey at Kobe on the 24th.

Other Casualties--The 4,443-ton CORAL ISIS encountered heavy weather off Australia on the 4th, 5th, and 6th with exceptionally high seas on the 5th. The ARAB ALHIJAZ for Bombay reported heavy-weather damage on arrival. The 16,293-ton ANTARTICO alleged shell damage between the 11th and 14th at Lirquen, Chile, due to heavy-weather grounding. The British ALNWICK CASTLE claimed heavy-weather damage on arrival at Port Kembla on the 17th.

Marine Weather Diary

NORTH ATLANTIC, OCTOBER

WEATHER. The frequency and strength of the LOWs increases during October over the middle and higher latitudes. The Icelandic Low which is centered between Greenland and Iceland has decreased to a mean central pressure of 1000 mb. This increases the north-south pressure gradient bringing higher winds and more severe storms. The Azores High is near 35°N, 35°W, somewhat diminished in size but still 1020 mb. The mean air temperatures have dropped north of latitude 30°N, ranging from 0°C at Davis Strait to 28°C over the Caribbean Sea. Along latitude 40°N the temperature ranges from 15°C off New Jersey to 20°C at 40°W to 18°C off Portugal. The sea-surface temperatures lag behind the air temperatures. The 0°C line is on the southern Baffin Island coast with 28°C in the Gulf of Mexico and Caribbean Sea. Along latitude 40°N the range is from 16°C south of Long Island to 19°C off Porto, rising to 21°C at 40°W. The 98 percent range is near 4°C either side of the mean.

WINDS. North of 40°N in the Atlantic, the prevailing winds are west and southwesterly with an average force 4 to 6. South of this latitude the prevailing winds are north and northeasterly over the eastern half and east and southeasterly over the western half except northeasterly over the Gulf of Mexico with windspeeds averaging force 2 to 4. The Mediterranean Sea has average winds of force 2 to 4 except over the Gulf of Lions where they average force 3 to 5. The prevailing wind direction for the Mediterranean Sea is northwesterly except over the central region where it is quite variable producing a weak southerly component.

GALES. The frequency of winds of force 8 or greater has increased significantly from previous months for middle and higher latitudes. An analysis of eight ocean station vessels north of 40°N indicates that generally 90 to 95 percent of the gales have durations of less than 36 hr. Areas reporting the highest frequency of gales (10 percent or more) are the Gulf of Lions and an area that covers the central Atlantic extending north of 50°N into the Davis and Denmark Straits.

EXTRATROPICAL CYCLONES. The temperature contrast along the Atlantic coast, from the Carolinas to the Gulf of St. Lawrence, is conducive to cyclogenesis. Other major areas of cyclonic development include an egg-shaped area extending from 50°N, 40°W, to 58°N, 30°W, and an area that extends from the Davis Strait across Iceland into the Norwegian Sea. Numerous primary tracks cross southeastern Canada and the northeastern United States heading into most areas north of 60°N between Baffin Bay and Norway. Secondary tracks cross Hudson Bay and southern England.

TROPICAL CYCLONES. The hurricane season continues into October with the frequency of tropical cyclones decreasing significantly from September. An average of 2 to 3 tropical cyclones will reach force 8 or greater during October with a little over half of these reaching hurricane strength (force 12). Most storms form over the western Caribbean, but a few are spawned near the Lesser Antilles. The preferred storm tracks leading from the Caribbean either head toward the U.S. Gulf Coast or recurve across Florida toward open water.

WAVE HEIGHTS. During October wave heights of 12 ft or higher are encountered 10 percent or more of the time along a southwest-northeast axis that leads from just north of Bermuda to the Barents Sea and east from the Labrador Sea to the Bay of Biscay and North Sea. Forty percent, which is the highest frequency of occurrence, extends north of 48°N to 62°N and east of 45°W to 12°W. Within the eastern half of this 40 percent area, 10 percent of the observations show wave heights of 20 ft or higher.

VISIBILITIES. Observations reporting visibilities less than 2 mi are less frequent and widespread during October than any other month. Areas reporting 10-percent frequencies, the highest observed, are located over the Bay of Fundy, waters along the east coast of Newfoundland and Baffin Island, British coastal areas, and north of a line from Kap Farvel to Bear Island.

NORTH PACIFIC, OCTOBER

WEATHER. The Aleutian Low has deepened about 8 mb since last month bringing the mean central pressure to under 1000 mb with a clearly defined center over Kodiak Island in the Gulf of Alaska. Two centers appear in the Pacific High as it elongates and becomes less influential, each with a pressure of just over 1020 mb centered near 35°N, 178°E, and 35°N, 138°W. Pressures have increased over eastern Asia and the western Pacific as the Siberian High increases in strength and pushes over the Yellow Sea and the Sea of Japan. With the onset of winter the mean 0°C surface air temperature isotherm has moved south from the Chukchi Sea to across St. Lawrence Island in the Bering Sea. Mean temperatures range from -8°C at 70°N to over 28°C in the southwest Pacific south of 22°N. Along the 40th parallel, the mean temperature is near 14°C off both the California and Asian coasts and near 18°C at 145°W. Most temperatures (98 percent) fall between -20°C and 4°C over the Chukchi Sea, between 8°C and 24°C at 40°N, and between 24°C and 32°C at the Equator, except 20°C to 28°C off South America.

WINDS. By October, the Aleutian Low has become as dominant a feature as the Pacific Subtropical High. Westerly winds prevail between 35°N and 60°N with the exception of the northerly winds along Japan. At these latitudes the winds average force 4 to 6. North of 60°N, prevailing northerly winds average force 3 to 4 while over the East China Sea and South China Sea, northerly winds average force 3 to 6. From California to the Philippines, windspeeds average force 2 to 4. In this region the prevailing winds are easterly with the exception of northerly winds off California.

GALES. The frequency of winds of force 8 or greater have increased significantly from the previous warmer months. During October most gales are confined

primarily to the latitude band between 40°N and 60°N. Areas with the highest frequencies (10 percent or higher) are located to the east of the Kamchatka Peninsula, centered near 50°N, 163°E, and the region from the south coast of Alaska to 45°N and between 138°W to 179°E.

EXTRATROPICAL CYCLONES. The principal area of cyclogenesis now lies more east-west, extending from the Sea of Japan to near 170°E. The north-south extent of the area is from 30°N to 45°N. The primary storm tracks run from southwest to northeast with one extending from southeastern Japan to near 52°N, 158°W, where it divides into a northerly track to Alaska and an easterly one to Canada. A second track runs from southern Sakhalin across the Commander Islands into the western Bering Sea with a third track running from west to east just south of the western edge of the Aleutian Chain.

TROPICAL CYCLONES. The frequency of tropical cyclones begins to decrease in October. An average of 2.2 tropical cyclones per year of force 8 or greater ($\geq$ 34 kn) occur in the eastern North Pacific and 4.3 in the western North Pacific. Of these, an average of 1.0 will reach hurricane strength ($\geq$ 64 kn) in the eastern North Pacific and 3.3 in the western North Pacific. The preferred track over the western ocean is westward along latitude 15°N from 160°E into the South China Sea with about half turning northeastward east of Luzon passing east of Japan. Over the eastern ocean they form south of Guatemala and track toward the Baja Peninsula or parallel latitude 17°N.

WAVE HEIGHTS. In general, most areas between 25°N and the northern Bering Sea and between Japan and North America experience wave heights of at least 12 ft, 10 percent or more of the time. Ten percent frequencies are also encountered from the northern Philippines to the East China Sea and over the east central Philippine Sea. Frequencies increase over the North Pacific to a maximum of 30 percent from south of Kodiak Island to latitude 50°N between longitude 140°W and the Aleutians.

VISIBILITES. During October, visibilties of less than 2 mi are less frequent and widespread than at any time of the year, but most regions north of 40°N have observed frequencies of 5 percent or more. The highest frequencies, of just over 10 percent, occur northwest of St. Lawrence Island, along the coastal region of North America from central California to southeastern Alaska, and in midocean along the 45th parallel from Kuril Islands to 160°W and from 145°W to 135°W.

NORTH ATLANTIC, NOVEMBER

WEATHER. The Icelandic Low is still centered between Kap Farvel and Keflavik with a central pressure of 1002 mb slightly higher than October or December. This appears to be the result of fewer low-pressure centers traversing the area, not weaker storms, as the mean wind has increased slightly and high waves are found more frequently. The Azores High at 1021 mb has shifted northeastward to 38°N, 30°W. The mean air temperature shows a marked decrease this month. The mean ranges from -4°C over Baffin Bay to a small area of 28°C over the Caribbean Sea. The mean temperatures along the 40°N parallel ranges from 11°C off New Jersey to a high of 18°C at 40°W to 15°C off the Portuguese Coast. The 98-percent temperature range has increased north of the Tropics, especially over the western ocean where it is as much as 10°C below the mean and 8°C warmer. The sea-surface temperatures are slowly cooling, ranging from -2°C near Baffin Island to 28°C in the Tropics. The mean temperatures along 40°N latitude range from 13°C off New Jersey to 20°C near 55°W to 16°C off Portugal. The 98-percent range is still about 4°C either side of the mean except off the U.S. coast.

WINDS. Prevailing westerly winds of force 4 to 6 span most of the Atlantic between 40°N and 60°N. Winds north of 60°N are quite variable, averaging force 4 to 6, and in establishing a prevailing direction they tend to be southwesterly over the eastern Norwegian Sea and northerly between 5°W and Hudson Bay. South of 40°N, the prevailing winds are generally from the east and northeast averaging force 2 to 4.

GALES. Winds of force 8 or greater have increased from the previous month with nearly all unprotected areas north of 38°N reaching a frequency of 5 percent. Most of the central Atlantic north of 45°N reaches 10 percent with the highest frequency being off the southeast tip of Greenland, where it approaches 20 percent.

EXTRATROPICAL CYCLONES. Major areas of cyclogenesis include an area that extends along the coast from the southeastern United States to Nova Scotia, an elliptical area (approximately 14 degrees by 9 degrees) centered near 50°N, 40°W, and an area extending from southeast Greenland to near 05°W. Leading from the Great Lakes, the majority of extratropical lows cross the Gulf of St. Lawrence and head for southwest Greenland. Other primary tracks lead from near 38°N, 60°W, and cross Iceland into the Norwegian Sea, and across Hudson Bay. Secondary tracks lead from Lake Winnipeg across Ontario, across the British Isles and southern Scandinavia into eastern Europe, and across the northwestern Mediterranean from northern Spain to Yugoslavia.

TROPICAL CYCLONES. Tropical disturbances have decreased substantially since the warmer months. On the average, only 7 cyclones in 10 years will reach force 8 or greater, with only 3 of these reaching hurricane strength (force 12). Most of these storms develop over the Caribbean Sea with the preferred tracks either crossing the Yucatan Peninsula bound for the eastern Gulf States or crossing Cuba and heading northeastward into open water.

WAVE HEIGHTS. Wave heights of 12 ft or more are encountered more than 10 percent of the time over most open ocean north of 32°N and east of the Davis Strait. Frequencies of 10 percent are also found in the Mediterranean Sea between Majorca and Sardinia. The region south of Iceland between Greenland and Ireland observes wave heights of at least 12 ft 40 percent of the time, and of at least 20 ft 10 percent of the time. Within this region, a small area centered near 57°N 20°W, experiences wave heights of 12 ft or more 50

percent of the time, and 20 ft or more 15 percent of the time.

VISIBILITIES. The percent frequency of visibility less than 2 mi has only slightly increased since October. Areas reporting frequencies of 10 percent or more include: the Bay of Fundy; the Gulf of St. Lawrence; coastal areas off Newfoundland and Baffin Island; southern coastal regions off Greenland; the area north of a line from Angmagssalik, Greenland, to the Barents Sea; and portions of the Irish Sea and the southern part of the North Sea.

NORTH PACIFIC, NOVEMBER

WEATHER. Although mean temperatures are lower, only a slight southerly movement of the Aleutian Low is noted as it becomes centered near 57°N, 150°W with its mean central pressure remaining just under 1000 mb. Along the 30th parallel, the Pacific High extends from California to 150°E. Its mean central pressure of just over 1020 mb is centered near 32°N, 140°W. Pressures continue to rise near Japan and Korea as the Asiatic High continues to build. There continues to be a marked decrease in the mean air temperature off the Asian coast as far south as Taiwan. Off southern Kamchatka the temperature dropped from 7°C to 1°C. Means range from a -16°C over the Chukchi Sea to over 28°C in the southwest Pacific between the Equator and 20°N. Along the 40th parallel, means range from 8°C off Asia to 15°C in the eastern Pacific. Less than 2 percent of the observations fall outside the range of -32°C to 0°C in the Chukchi Sea, -2°C to 20°C at 40°N, and 20°C to 32°C at the Equator with the colder water off Ecuador. The mean sea-surface temperature ranges from freezing across the northern Bering Sea to 28°C south of 20°N. Along latitude 40°N the temperature averages 16°C except 12°C over the Sea of Japan and 14°C off California. The 98 percent range remains at about 4°C either side of the mean.

WINDS. The intensification of the Aleutian Low since October has had little effect on the general circulation pattern. The mean wind flow between 35°N and 60°N is west to southwest while south of 35°N, it is east to northeast. The exceptions are the prevailing northerly winds that are observed off California and in an area that extends from Japan to Malaysia. Winds average force 4 to 6 over the South China Sea and in most regions north of 30°N. The remaining areas of the North Pacific average force 3 to 5.

GALES. The frequency of gales ($\geq$ 34 kn) continues to increase with most unprotected areas between 30°N and 65°N reporting frequencies of at least 5 percent. The areas of highest frequency (10 percent or greater) stretch from the Gulf of Alaska to the Kuril Islands and from 40°N to the Bering Sea.

EXTRATROPICAL CYCLONES. The principal area of cyclogenesis over the North Pacific extends from the Sea of Japan to near 175°W and from 30°N to 47°N. The migration of lows across the Pacific move primarily from southwest to northeast following three primary tracks. The westernmost track extends from southeastern Russia across the Kuril Islands into the western portion of the Bering Sea. The central storm track extends from a region to the east of central Japan to Bristol Bay and the easternmost track extends from near 43°N, 175°W to near 47°N, 160°W where it branches northeastward into Alaska and eastward into the northwestern United States.

TROPICAL CYCLONES. Tropical cyclone activity continues to decrease across the North Pacific with the most significant decreases occuring in the eastern North Pacific. During an average time span of 10 years one can expect only 3 storms of force 8 or greater in the eastern North Pacific. Of these, it is unlikely that any will reach hurricane strength. In the western North Pacific for an equivalent period, 29 can be expected to reach force 8 or greater; of these, 21 are expected to reach force 12.

WAVE HEIGHTS. Wave heights of 12 ft or higher are encountered 10 percent or more of the time in most areas between the Hawaiian Islands and St. Lawrence Island and between Japan and North America. Ten percent frequencies are also encountered east of the Hawaiian Islands and from Vietnam to Okinawa. Frequencies increase to 20 percent over the South China Sea and to 30 percent between latitudes 45°N and 55°N and longitudes 135°W and 160°E.

VISIBILITIES. The percent of observations reporting visibilities of less than 2 mi has increased slightly since October. Most regions north of 40°N, report frequencies of at least 10 percent running northwest of a line from northern Japan to southwestern Alaska. Frequencies of 10 percent are also observed off the California coast near San Francisco, between Vancouver Island and the mainland, and in an area with a radius of approximately 300 mi centered near 50°N, 150°W. Frequencies of 20 percent are reported in the north central Sea of Okhotsk and in a narrow band that extends from the Commander Islands to the Bering Strait.

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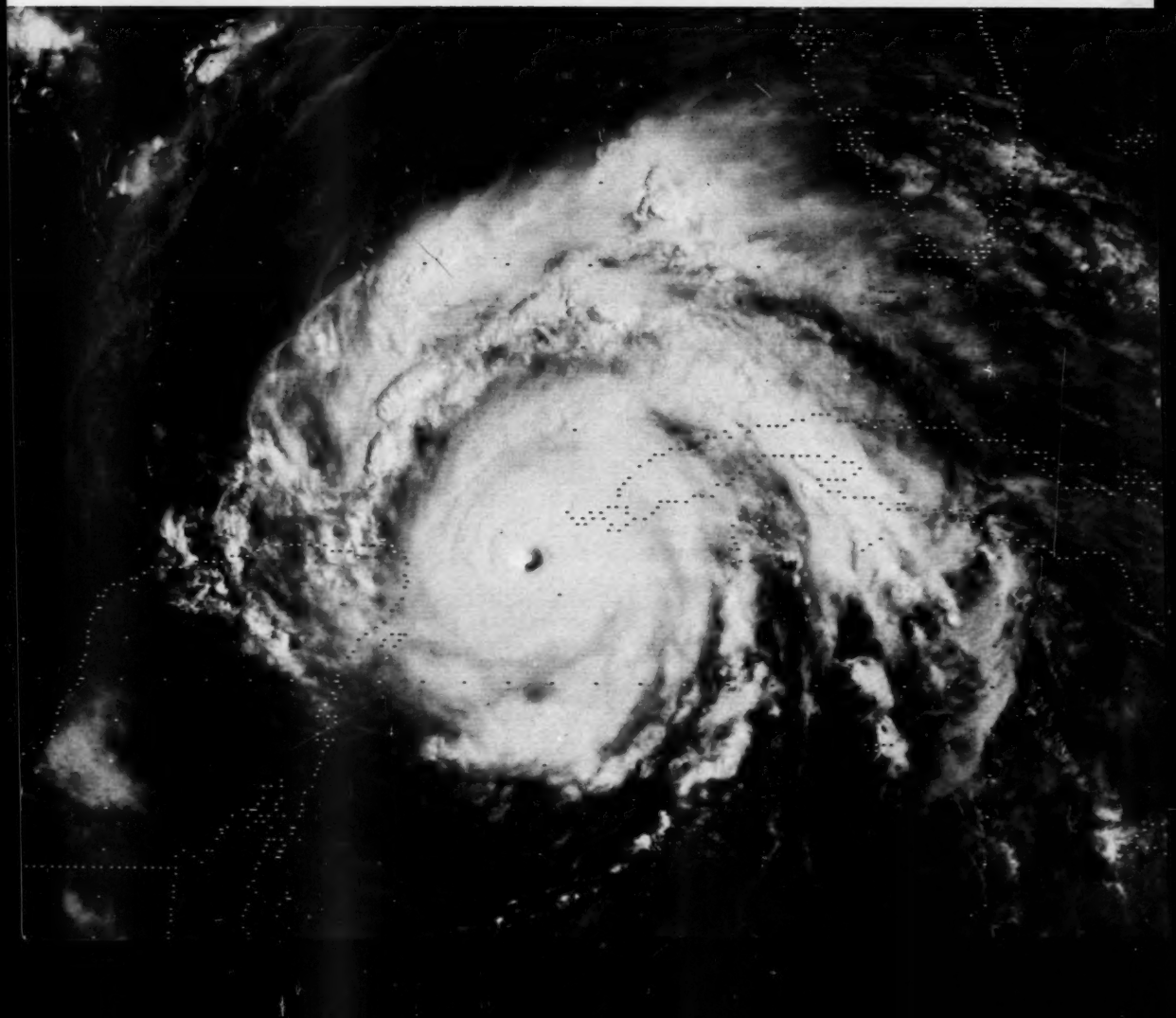
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